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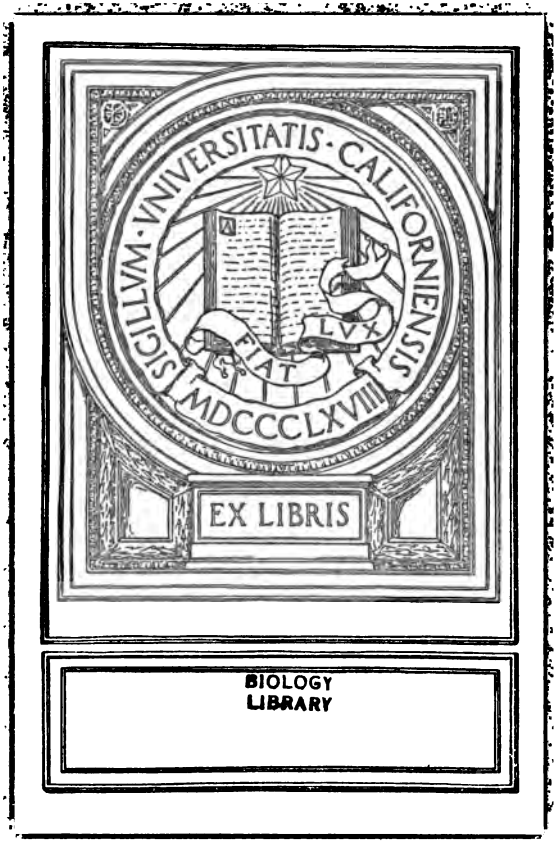


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J. HECTOR, M.D., C.M.G., F.R.S.,
DIRECTOR.

New Zealand

# MANUAL

OF THE

# INDIGENOUS GRASSES

OF

# NEW ZEALAND.

BY

JOHN BUCHANAN, F.L.S., LOND.,

BOTANIST AND DRAUGHTSMAN TO THE GEOLOGICAL SURVEY.

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# PREFACE.

THIS MANUAL is reproduced from the folio work on the GRASSES OF NEW ZEALAND, the preparation of which was ordered by the New Zealand Government in consequence of a resolution adopted by the House of Representatives on 29th June, 1876, on the motion of SIR GEORGE GREY, K.C.B., to the effect that a work on the Native Grasses of the Colony should be prepared, with nature-printed plates and descriptions of each species, and to be accompanied by an essay on the Grasses and Forage-plants likely to prove useful in New Zealand.

In the course of the discussion relative to the resolution it was urged that prizes should be offered for essays on the subject, and that the best essay should be incorporated with the work; but it was obvious that the original observation and experiment required to give value to such an essay could hardly be expected until the illustrated work was in the hands or those who although possessing a practical knowledge of the subject, might yet be unacquainted with the botanical nomenclature of the Grasses.

The preparation of the systematic portion of the proposed work was, therefore, committed to this Department in January, 1877, but the actual printing could not be commenced until December of the same year.

The whole of the illustrations of the large edition were drawn from nature by Mr. John Buchanan, F.L.S. To insure accuracy of form, the specimens of the various grasses were lightly inked, and faintly impressed on the prepared surface of the lithographic stone, but the details were filled in by hand, together with enlarged drawings showing the anatomical characters of the inflorescence in each species from original microscopic disections made by Mr. Buchanan, whose excel-

M167137

lent botanical knowledge, combined with his skill as a draughtsman, peculiarly fitted him for the work.

The condition imposed—that the plates should be nature-printed—rendered it necessary in the first instance to publish the work in *folio;* but, as this large size is both inconvenient and costly, only a small edition has been issued, and the present handy volume has been printed for more general distribution. The plates now given, sixty-four in number, and including eighty-seven different species and varieties of Grasses, are reductions by the process of photo-lithography from the original folio plates, and depict the Grasses as of one-half the natural size of the original specimens.

The descriptive letter-press accompanying the plates is brought down to a later date in the first part of this small edition, so as to include some changes of nomenclature which have been introduced during the few years that have elapsed since the corresponding pages of the folio volume were printed.

The Botanical information has been collected from the best authorities, but, in many instances, structural details are now furnished by Mr. Buchanan, which have not been previously published, and many of his remarks on the growth and value of the Grasses, founded on experience acquired during his twenty-seven years' residence in the Colony, possess great value, although, in view of the expected essay on this branch of the subject they have been made as brief as possible.

The general system of the classification of the Grasses has been adopted from SIR JOSEPH HOOKER'S standard works on the New Zealand Flora; but the method upon which the general and specific characters have been arranged, is from a more recent work on the British Flora, by the same distinguished botanist.

Whilst this work has been in press the Seventh Volume of BENTHAM AND MUELLER'S *Flora Australiensis* has been received, which contains a few unimportant changes of name so far as they affect those Grasses which are found to occur both in Australia and New Zealand, but it has seldom been possible to adopt these changes in the present work, as the plates with the previously accepted names of these Grasses were already printed off. To the practical farmer, for whose assistance this work is chiefly designed, the alteration of the scientific names is of comparatively little importance, but, to assist botanists in referring to

the above mentioned standard work, a list of the recent alterations is appended.

The specimens of the New Zealand Grasses described in this work are all preserved in the Colonial Herbarium, in Wellington; and the sources from which they have been received are duly acknowledged in every instance when they have not been collected by Mr. Buchanan himself. As some few grasses have been discovered very recently, and by different collectors, it has been difficult to avoid the duplication of specific names in cases where they have been independently described by different authors, but the cases in which such duplication has been ascertained are recorded in the list of addenda.

JAMES HECTOR,
Director.

Colonial Museum, January, 1880.

# ADDENDA ET CORRIGENDA.

Page 1. *Ehrharta colensoi*, Hook. fil., has been recently collected in the South Island, on Mount Arthur, 6000 feet altitude, by Mr. McKay, of the Geological Survey Staff, and also on the mountains above Arthur's Pass, by J. F. Cheeseman, F.L.S., Auckland Museum. *Ehrharta Thomsoni*, Petrie, n. sp., a recent discovery by Mr. Petrie, on Stewart Island.

,, 11, line 12 from bottom—for Holeus read Holcus.

,, 13. *Hierochloe alpina*, Rœm and Schultes. This species has been incorporated with *Hierochloe redolens*, R. Brown, as var. Fraseri. As regards New Zealand this change appears injudicious, as they form here two distinct species without intermediate forms.

,, 21. *Panicum imbecille*, Trinius. This grass is now *Oplismenus setarius*, Rœm and Schultes.

,, 29. *Dichelachne stipoides*, Hook. fil. This grass is now *Stipa teretifolia*, Steud, being separated from *Dichelachne* and placed in *Stipa* from the awn articulating on the glume. The present species, with the recent discovery of *Stipa petriei*, adds a new Genus to the Order Gramineæ in New Zealand.

,, 37. *Sporobolus elongatus*, R. Brown, is now *Sporobolus indicus*, R. Br. The New Zealand plant has the flowering glume 3-nerved, and more robust than that of Australia.

,, 39. Genus *Agrostis*. This genus must be subdivided, and all the species having a pencil or tuft of hairs rising from the base of the flowering glume should be transferred to the Genus *Deyeuxia*, described in p. 173 in connection with the new species *D. scabra*.

,, 43. *Agrostis canina*, Linn., var. B., gelida, is now *Agrostis muelleri*, Benth. *Agrostis canina*. Linn., var. C., subulata, is now *Agrostis subulata*, Hook. fil.

,, 49. *Agrostis parviflora*, R. Brown, is now *Agrostis scabra*, Willd.

,, 51. For *Agrostis œmula*, R. Brown, read *Deyeuxia forsteri*, Kunth.

,, 51. *Agrostis œmula*, R. Brown, add var. c. *spathacea*, n. sub-spec., Berggren, Report Royal Society, Lund, 1878.

,, 53. For *Agrostis pilosa*, A. Rich, read *Deyeuxia pilosa*.

,, 53. For *Agrostis billardieri*, R. Brown, read *Deyeuxia billardieri*, Kunth.

,, 57. For *Agrostis setifolia*, Hook. fil., read *Deyeuxia setifolia*, Hook. fil.

,, 59. For *Agrostis avenoides*, Hook. fil., read *Deyeuxia avenoides*.

,, 61. For *Agrostis youngii*, Hook. fil., read *Deyeuxia youngii*.

,, 63. For *Agrostis quadriseta*, R. Brown, read *Deyeuxia quadriseta*.

,, 70, after No. 10—add Flowering glume with 2 tufts of hairs on each margin.

,, 79, line 15 from bottom—delete "generally the largest and."

,, 127. *Poa pusilla*, Berggren, Report Royal Society, Lund, 1878. This equals *Poa anceps*, var. minimè, of the present work.

,, 143. *Poa sclerophylla*, Berggren, Report Royal Society, Lund, 1878. This equals *Poa anceps*, var. e., Alpina, Hook. fil., Hand. N.Z. Flora, I. 339, also *Poa albida*, of the present work.

,, 151, line 2 from bottom—for maratine read maratime.

,, 153. For *Poa imbecilla*, Forst., read *Eragrostis imbecilla*, Benth.

,, 153. For *Festuca littoralis*, Labill, read *Schedonorus littoralis*, Beauv. This species is not so common on the coasts of New Zealand, as a larger form, *Schedonorus littoralis*, var. *triticoides*, this variety is the *Festuca triticoides*, Steud; both plants are figured on Plate LIV.

,, 159, line 3 from bottom—for chest read best.

,, 163. For *Triticum scabrum*, R. Brown, read *Agropyrum scabrum*, Beauv.

Plate XX.A., for Agrostis canina, var. B., gelida—read Agrostis, Muelleri.
Plate XX.B., for Agrostis canina, var. C., subulata—read Agrostis, subulata.
For Plate XXXIII. Danthonia flavescens—read Plate XXXII.

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# SYSTEMATIC DESCRIPTION OF THE ORDER GRAMINEÆ.

GRASSES.—Roots tufted and fibrous; large succulent-rooted tussacs, or creeping rhizomes. Culms hollow, knotted and closed at the joints, rounded. Leaves alternate, usually distichous, very long or short, sheathing part of leaf split longitudinally on one side, with generally a membranous appendage at the summit called a ligule. Florets mostly perfect, imbricated on a common axis within a calyx, the latter composed of two or more empty glumes, the whole forming a spikelet. Flowers (stamens, pistil, and ovary) enclosed within two glumes, the lower (flowering glume) generally keeled with one or more nerves, the upper (palea) two-nerved, rarely one-nerved. Perianth probably represented by two to three small scales, situated beneath the ovary. Stamens usually three, filaments capillary, anthers attached by the back, versatile. Ovary one-celled, with one erect ovule. Styles two, united at the base, stigmas feathery, with sometimes branched stigmatic hairs. Fruit a grain, sometimes adhering to the palea. Seed closely adhering to the pericarp, embryo on one side at the base of the albumen, generally pear-shaped.

A most important order of phaenogamous plants abundantly spread over the surface of the earth, and exceeding in number of individuals any other order of plants. The grain of several species form important articles of food for man, and the aggregation of species as pasture supply food for numerous herbiverous animals, and in many the fibrous part of their structure also offers an abundance of economic material for the manufacture of various products, such as paper.

A. Spikelets on the spines of globose, polygamous, involucrate heads. 5. Spinifex.

B. Spikelets sessile, in 1 or 2 series, on one or both sides of a flattened rachis.

Empty glumes 0 or 1–3.

Empty glumes 2 or 3, short; flowering solitary, hard . 6. Paspalum.
Empty glume 1, margins connate; flowering solitary, Palea O. 9. Zoysia.
Empty glumes 2, lanceolate; flowering 3–16, awned . . 25. Triticum.
Empty glume 0, or 2 bristles; flowering 1–3 awned. . . 26. Gymnostichum.

C. Spikelets never sessile and distichous, pedicelled, panicled or racemed.

I. Empty glumes 3 or more, below the solitary hermaphrodite flowering one.

Glumes 5; 4 empty, acuminate, 1 flowering, obtuse . . 1. Ehrharta.
Glumes 5; 2 empty, minute, 2 empty, awned, 1 flowering, acuminate. . . . . 2. Microlæna.
Glumes 4. short, obtuse; 2 empty, 1 male, upper hermaphrodite. . . . . 8. Isachne.
Glumes 4, mucronate or awned; 2 empty, 1 male, upper, hermaphrodite . . . . . 7. Panicum.

II. Empty glumes 2, below the solitary flowering one.

*a.* Panicle dense, cylindric, spike-like, (see Poa anceps and Danthonia in III.)

Empty glumes equal, flattened, Palea O. Panicle soft, spiciform. . . . . 3. Alopecurus.
Empty glumes rigid, acuminate, Panicle reduced to an ovid, spinulose head . . . . . 10. Echinopogon.

*b* Panicle effuse or contracted.

| | |
|---|---|
| Flowering glume on a bearded pedicel, tip 2-fid, awned. | 11. Dichelachne. |
| Flowering glume pedicelled, ending in a long rigid awn. | 12. Apera. |
| Flowering glume sessile, short, acute ; seed loose in pericarp, | 13. Sporobolus. |
| Flowering glume sessile, truncate, awned at back or awnless | 14. Agrostis. |
| Flowering glume pedicelled, with a short dorsal awn | 14.$_2$. Deyeuxia. |
| Flowering glume rigid, rolled round the flower, awn bent and articulated | 12.$^2$. Stipa. |

III. Empty glumes 2, below the 2 or more flowering ones. Flowering glumes rarely 1 in Poa, Danthonia, and Deschampsia.

*a*. Flowering glumes awned, sometimes awnless in Hierochloe (see Festuca in *b*).

| | |
|---|---|
| Flowering glumes 2–5, silky ; awn at the 2-fid tip, slender. | 15. Arundo. |
| Flowering glumes 2–8, 2 cuspidate, with stout dorsal awn, and long hairs on sides and at base | 16. Danthonia. |
| Flowering glumes 2–4 silky, at base, 3 awned, middle one longest | 19. Trisetum. |
| Flowering glumes 2 or 3, shining, truncate, or 4-toothed. | 17. Deschampoia. |
| Flowering glumes 3, shining, obtuse, 2 lateral male flowers 3-androus, central flower, male and female, 2 androus | 4. Hierochloe. |
| Flowering glumes 3–7, shining, 2-fid, with a short obtuse awn, or O. Panicle spiciform. | 18. Koeleria. |
| Flowering glumes 4–10, 2-fid, with an intermediate awn. Ovary villous at top. | 24. Bromus. |

*b*. Flowering glumes not awned except in some Festucas, (see Hierochloe and Koeleria in *a*).

| | |
|---|---|
| Flowering glumes 6–14, short, obtuse, green, Scales connate. | 20. Glyceria. |
| Flowering glumes 2, short, truncate, erose, membranous. | 21. Catabrosa. |
| Flowering glumes 2–10, compressed, keeled, obtuse or acute | 22. Poa. |
| Flowering glumes 2–10, convex or keeled at back, often awned at the entire tip. | 23. Festuca. |

# ARRANGEMENT OF THE GENERA ACCORDING TO THE NATURAL SYSTEM.

* Spikelets with 1 fertile terminal flower, with or without a male or imperfect flower below it.

1. ORYZEÆ.—Flowering glumes hardening, and enclosing the grain ; Empty glumes 4 or 5, unequal, laterally compressed, lower smaller.— 1. Ehrharta ; 2. Microlæna.

2. PHALARIDEÆ.—Flowering glume and palea hardening, and enclosing the grain. Empty glumes 2, equal, laterally compressed, keeled, longer than the flowering.—3. Alopecurus ; 4. Hierochloe.

3. PANICEÆ.—Flowering glume and palea hardening, and enclosing the grain. Empty glumes 2-4, outer smaller, often dorsally compressed.—5. Spinifex ; 6. Paspalum ; 7. Panicum ; 8. Isachne.

4. ANDROPOGONEÆ.— Flowering glume small, thin, transparent, or O.—9. Zoysia.

** Spikelets with 1 or more perfect flowers, the male or imperfect flowers, if present, above the perfect ones, the axis or rachis often ending in a point or bristle.

5. AGROSTIDEÆ.—Spikelets, 1-flowered. Flowering glume, awnless, or with a simple awn, Grain free.—10. Echinopogon ; 11. Dichelachne ; 12. Apera ; 13. Sporobolus ; 14. Agrostis ; 14.2. Deyeuxia.

6. STIPACEÆ.—Spikelets 1-flowered. Flowering glume firm, with a simple or 3 cleft awn jointed on to its tip, closely enveloping the grain.—12.2. Stipa.

7. ARUNDINEÆ.—Spikelets usually 2-or more flowered, rachis with long silky hairs. Glumes all membranous free.—15. Arundo.

8. AVENACEÆ.—Spikelets 2 or more flowered. Flowering glumes on a slender rachis, usually shorter than the empty ones, membranous, shining, split at the top with an intermediate awn that is often twisted at the base, (rarely awnless).—16, Danthonia ; 17, Deschampsia ; 18, Koeleria ; 19, Trisetum.

9. FESTUCACEÆ.—Spikelets usually 4 or more flowered. Flowering glumes usually longer than the empty ones, on a flexuous rachis.—20, Glyceria ; 21, Catabrosa ; 22, Poa ; 23, Festuca ; 24, Bromus.

10. HORDEACEÆ.—Spikelets 1 or more flowered (spiked) sessile on opposite sides of a simple rachis, solitary or 2 or 3 together, the glumes standing right and left to the axis of the spike.—25. Triticum. 26. Gymnostichum.

# MANUAL

OF THE

# NEW ZEALAND GRASSES.

Order GRAMINEÆ.

GENUS I.—EHRHARTA, Thunberg.

*Spikelets* panicled, 1-flowered. *Empty glumes* 4, keeled, compressed, acuminate. *Flowering glume* terminal, obtuse. *Palea* linear, obtuse. *Scales* 2, 2-lobed. *Stamens* 2—6. *Ovary* glabrous, sessile. *Styles* short. *Stigmas* with short hairs. *Grain* free within the hardened glume. DISTRIBUTION OF GENUS: AUSTRALIA, SOUTH AFRICA, NEW ZEALAND. *Etymology:* Named in honour of FREDERICK EHRHART, a Swiss Botanist.

## 1.—EHRHARTA COLENSOI.

**ALPINE RICE GRASS.**

*(Plate I.)*

EHRHARTA COLENSOI, Hook. fil. Fl. N.Z., 288, t. 65A; Handb. N.Z. Flora, I., 319.

A TUFTED, glabrous, alpine grass, growing at 5000 feet altitude. *Flowers* in January, Perennial. *Root* fibrous, wiry. *Stems* 4—10 inches high. *Leaves* erect, distichous, 2—4 inches long, contracted at the sheath, $\frac{1}{8}$—$\frac{1}{4}$-inch broad, linear-subulate, scaberulous above, smooth below, nerves faint, ligule short, lacerate. *Panicle* contracted, $1\frac{1}{2}$—2 inches long, erect or inclined. *Spikelets* on slender pedicels, compressed, linear-oblong, $\frac{1}{4}$—$\frac{1}{3}$-inch long. *Empty glumes*, lower pair short, oblong, acute, 5—7-nerved, central nerves stout; upper pair twice as long as the lower, narrow-lanceolate, almost awned, 7-nerved, and with a tuft of silky hairs at the base. *Flowering glume* shorter, linear-oblong, obtuse, 9-nerved. *Palea* narrow-linear, obtuse, 2-nerved, and with a small bristle at the base. *Scales* 2-lobed, irregularly serrate on the lobes, and nerved below. *Stamens* 2. *Anthers* short, stout. *Ovary* ovate-oblong. *Styles* short. *Stigmas* feathery. *Grain* ovate-oblong. DISTRIBUTION OF SPECIES: NEW ZEALAND.

This grass has only been found on the Ruahine and Tararua Mountains, in the North Island; it grows in flat tufts or tussacs on the open land above the limits of bush. Very little is known of its value as a pasture grass, its limited distribution preventing opportunities for observation or experiment as to its fitness for cultivation at lower levels. From the known fact, however, that many of these alpine grasses are very succulent and fattening, and much relished by sheep during the summer months, this species may prove valuable when the extensive sub-alpine country in the neighbourhood of these mountains is opened up for settlement. DISTRIBUTION IN NEW ZEALAND: NORTH ISLAND: RUAHINE MOUNTAINS—Colenso; TARARUA MOUNTAINS—H. H. Travers.

Reference to Plate I.: Fig. 1. Plant. 2. Spikelet. 3. Upper pair of empty glumes and floret. 4. Floret. 5, 5′. Nervation of lower pair of empty glumes. 6, 6′. Nervation of upper pair of empty glumes. 7. Nervation of flowering glume. 8. Nervation of Palea. 9. Scales. 10. Ovary. 11. Grain.

Ehrharta Colensoi, *Hook fil.*

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## GENUS II.—MICROLÆNA, Brown.

*Spikelets* racemed or panicled, 1-flowered. *Empty glumes* 4: two lowermost opposite, minute; two following awned, much larger. *Flowering glume* terminal, acuminate, or awned. *Palea* short, linear, hyaline. *Scales* 2. *Stamens* 2—4. *Ovary* sessile. *Styles* short. *Stigmas* feathery. *Grain* free within the hardened glumes. DISTRIBUTION OF GENUS: AUSTRALIA, TASMANIA, NEW ZEALAND. *Etymology*: Named from two Greek words meaning "small" and a "covering," in allusion to the small outer glumes.

ARRANGEMENT OF THE SPECIES:—

I.—*Two lowest glumes distant from the following* ... 1. *M. stipoides.*

II.—*Two lowest glumes close to the following* (Diplax)—

Spikelets panicled. Leaves scaberulous, $\frac{1}{4}$—$\frac{1}{2}$-inch broad. Stamens 2 2. *M. avenacea.*

Spikelets racemed. Leaves smooth, $\frac{1}{12}$—$\frac{1}{6}$-inch broad. Stamens 4 3. *M. polynoda.*

## 1.—MICROLÆNA STIPOIDES.

**MEADOW RICE GRASS.**

*(Plate II.)*

MICROLÆNA GUNNII. Hook. fil. Fl. Tasm., II., 105, t. 155. A.; EHRHARTA STIPOIDES, Brown. Labill. Fl. Nov. Holl., I., 16, t. 118; F. Muell. Fragm. VII., 90; MICROLÆNA STIPOIDES, Brown. Hook. fil. Fl. Tasm., II., 105, Fl. N.Z., I., 289; Handb. N.Z. Flora, I., 320;

A SLENDER grass, on low grounds. *Flowers* November—January. Perennial. *Root* fibrous. *Stems* 12—24 inches high. *Leaves* glabrous or sparingly hairy, 2—6 inches long; *ligule* very short, obtuse, entire or lacerate; mouth of sheath with silky hairs. *Panicle* slender, upright or inclined; branched below. Lower *spikelets* on long pedicels, upwards

of one inch in length, awns included. *Empty glumes*, lowest pair very minute, acute, deciduous; two following seated at distant intervals on the bearded rachis, scabrid, 7-nerved. *Flowering glume* acuminate or obtuse, with a short awn, 7-nerved. *Palea* linear, obtuse, 1-nerved. *Scales* large, triangular, incised at top and nerved at bottom. *Stamens* 4. *Anthers* long, very narrow. *Styles* short, nearly connate at the base. *Stigmas* feathery. *Grain* long, narrow, linear. DISTRIBUTION OF SPECIES: AUSTRALIA, TASMANIA, NEW ZEALAND.

A valuable pasture grass, and affording sufficient bulk to add value to mixed fodder. It is confined, as far as at present known, to the north and middle parts of New Zealand, and, although abundant in certain localities, is apparently not widely distributed. This grass is highly spoken of by Mr. Bacchus, in Australia, in the Second Annual Report of the Secretary for Agriculture in Victoria, where he says: "It is a good fattening grass, affording nutriment for stock during winter, and does not suffer so much from overstocking as the Kangaroo grass." No doubt this is due to its deep-seated roots, which enable it to withstand the dry heats of summer. Mr. Kirk also reports favourably of this grass in Auckland, "as being closely cropped by horses, cattle, and sheep," and points out that it grows there with equal luxuriance on the light scoria and tertiary clay soils. Its most frequent habitat near Wellington is on the river-flats near the sea-shore, and it is obviously a grass that thrives best in moist places. As an early spring grass it is worthy of cultivation, and deserving of a wider distribution, but, from its having few fertile florets, and consequently producing a small amount of seed, experiments in this direction will require much attention and labour. Failing success by seed, propagation by the roots may be recommended in this case and others where the plants do not seed freely. DISTRIBUTION IN NEW ZEALAND: NORTH ISLAND: EAST CAPE, HAWKE'S BAY, and CAPE PALLISER—Colenso; AUCKLAND —Sinclair, Kirk; CAPE MARIA and KAWAU ISLANDS—Buchanan; SHORES OF COOK STRAIT—Kirk. SOUTH ISLAND: NELSON—Buchanan.

Reference to Plate II.: Fig. 1. Plant. 2. Spikelet. 3. Floret. 4. Nervation of upper pair of empty glumes. 5. Nervation of flowering glume. 6. Nervation of Palea. 7. Scales. 8. Ovary. 9. Grain.

Microlæna stipoides, *Br.*

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## 2.—MICROLÆNA AVENACEA.

**BUSH RICE GRASS.**

*(Plate III.)*

DIPLAX AVENACEA, Raoul, Choix des Plantes, p. 11, t. 3. Fl. N.Z., I., 289. MICROLÆNA AVENACEA, Hook. fil. Handb. N.Z. Flora, I., 320.

A TALL handsome grass, growing at low elevations. *Flowers* December —March. Perennial. *Root* fibrous, wiry. *Stems* 2—4 feet high, densely tufted, compressed and leafy at the base, forming tussacs of erect drooping leaves. *Leaves* 18—24 inches long, ¼—⅓-inch broad; margins scabrid. *Ligule* very short, obtuse, entire, or lacerate; mouth of the sheath with silky hairs. *Panicle* glabrous, pale-coloured, 10—15 inches long, with many long capillary branches. *Spikelets* on capillary pedicels ½-inch long, awns included. *Empty glumes*, lower pair very minute, unequal, persistent; upper pair close to the last, with long awns, 7-nerved. *Flowering glume* acuminate or blunt, with a short awn, 7-nerved. *Palea* narrow, linear, acuminate, 1-nerved. *Scales* large, waved on the upper margin, and nerved at bottom. *Stamens* 2. *Anthers* long, narrow. *Styles* nearly connate at the base. *Stigmas* penicillate, longer than the styles. *Grain* long narrow. DISTRIBUTION OF SPECIES: NEW ZEALAND.

**Common in forest lands, and usually found there in small tussacs, which, by their confluence, often form large patches of a close, harsh sward, especially in the more open places. This grass is greedily eaten by cattle during winter, when it then becomes valuable in supplementing the more nutritious leaf food from certain trees, such as Karaka (*Corynocarpus lævigata*), Mahoe (*Melicytus ramiflorus*), and several others which form their chief food during that season in many places. This species can hardly be recommended for cultivation, as in open country it would very probably become harsher and less succulent; but settlers living in the neighbourhood of forests would be repaid the trouble of collecting seed and sowing it among the trees, and by that means increasing the amount of winter food for their cattle. DISTRIBUTION IN NEW ZEALAND: NORTH AND SOUTH ISLANDS; abundant in forests.**

Reference to Plate III.: Fig. 1. Plant. 2. Spikelet. 3. Upper empty glumes and floret. 4. Fertile floret. 5. Nervation of upper empty glumes. 6. Nervation of flowering glume. 7. Nervation of palea. 8. Scales. 9. Ovary. 10. Grain.

Microlæna avenacea. *Hook fil.*

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# 3.—MICROLÆNA POLYNODA.

**KNOT-JOINTED RICE GRASS.**

*(Plate IV.)*

DIPLAX POLYNODA, Hook. fil. Fl. N.Z., I., 290. MICROLÆNA POLYNODA, Hook. fil. Handb. N.Z. Flora, I., 320.

A LARGE, glabrous, tufted grass, on open land, rambling among scrub, 3—6 feet long, ascending to 1000 feet. Perennial. *Flowers* December —February. *Culms* slender or stout, rigid, terete, branched, with knots at the joints. *Leaves* 4—8 inches long, narrow; *ligule* acute, fringed with long hairs. *Racemes* simple, few-flowered; upper *spikelets* sessile, lower shortly pedicelled, ½-inch long, awns included. Lowest pair of *empty glumes* minute, unequal, persistent; upper pair shortly awned, 7-nerved. *Flowering glume* very shortly awned, 7-nerved. *Palea* narrow, acute, 1-nerved. *Scales* large, ovate, acuminate, ciliate at top. *Stamens* 4. *Anthers* long, narrow. *Ovary* and *grain* not seen. DISTRIBUTION OF SPECIES: NEW ZEALAND.

This grass has a very limited distribution, and, having only been collected in a few localities, and found nowhere abundantly, little is known of its value either in pasture or as fodder. Its tough wiry leaves are never likely to form a sward that will afford food for sheep, while its sparse habit does not recommend it as fit for being cut as fodder. The larger cattle, however, seldom refusing the coarsest herbage, and often relishing several of the harshest-cutting *Cyperaceæ*, may find in this grass, especially when in flower, sufficient to induce them to eat it. As an ornamental grass it has much to recommend it, and it might be judiciously introduced where ponds or streams require decoration. DISTRIBUTION IN NEW ZEALAND: NORTH ISLAND: AUCKLAND NORTH—Kirk; BASE OF THE RUAHINE MOUNTAINS AND EAST COAST—Colenso. WELLINGTON—Buchanan. SOUTH ISLAND: CANTERBURY—Armstrong DUNEDIN —Buchanan.

Reference to Plate IV.: Fig. 1. Plant. 2. Spikelet. 3. Floret. 4, 5. Nervation of upper pair of empty glumes. 6. Nervation of flowering glume. 7. Nervation of palea. 8. Scale.

Microlæna polynoda, *Hook. fil.*

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## Order GRAMINEÆ.

### GENUS III.—ALOPECURUS, Linnæus.

CREEPING or erect, glabrous or downy grasses. *Spikelets* laterally compressed, imbricated in spike-like cylindrical panicles, 1-flowered. *Empty glumes* sub-equal, keeled, usually connate at the base; awn straight dorsal. *Palea* 0. *Scales* 0. *Stamens* 3. Grain free within the hardened glumes. DISTRIBUTION OF GENUS: NORTH AND SOUTH TEMPERATE COUNTRIES. *Etymology*: From two Greek words signifying "a fox" and "a tail."

## 1.—ALOPECURUS GENICULATUS.

**KNEE-JOINTED FOX-TAIL GRASS.**

*(Plate V.)*

ALOPECURUS GENICULATUS, Linnæus. English Botany, 1250. ALOPECURUS PANICEUS, Œder. ALOPECURUS AUSTRALIS, Nees. In Mitchell's "Australia." F. Muell., Fragm. VIII., 138. ALOPECURUS GENICULATUS, Linnæus. Hook. fil., Fl. Tasm. II., 109; Fl. N.Z., I., 290; Handb. N.Z. Flora, I., 320.

A GRASS of moist habitats or shallow water-pools, often floating on the water, where it presents when in flower, a conspicuous display of pale flesh-coloured spikes. Found from near sea-level to 3500 feet altitude. *Flowers* November—December. Perennial. *Roots* fibrous. *Culms* creeping at the base, ascending, bent at the joints, and often rooting at the nodes, 1—2 feet high. *Leaves* glabrous, flat, soft, slightly scabrous on the edges; sheaths large, grooved; *ligule* long, membranous. *Panicle* spike-like, cylindric, obtuse, $1\frac{1}{2}-2\frac{1}{2}$ inches long; *rachis* woolly. *Spikelets* numerous, 1-flowered. *Empty glumes* connate at the very base, membranous, compressed; keel with long bristles, 3-nerved. *Flowering glume* ovate, 7-nerved; awn variable in length and position. *Palea* 0. *Anthers* large. *Styles* nearly connate at the base. *Stigmas* with short simple hairs. *Ovary* glabrous. DISTRIBUTION OF SPECIES: EUROPE, NORTH AMERICA, NORTH ASIA, AUSTRALIA, TASMANIA, NEW ZEALAND.

Opinions of authors, regarding the value of this grass in pasture, are conflicting. Lowe, in his work on British grasses, says of it, "A common grass, rejected by cattle." Again, Charles Johnson, in a work on British grasses, says, "Most of the grazing animals devour this grass with avidity." And again, Sinclair, in his "Hortus Gramineous Woburnensis," gives the following opinion regarding its value: "It does not appear to be eaten with much relish by either horses, cattle, or sheep; its nutrient powers are not considerable, and, from its sub-aquatic habit, it cannot be recommended for cultivation."

This latter opinion is probably a fair estimate of its value as a pasture grass, and, as it has also little bulk to recommend it as a fodder plant, it may be left to its own natural power of increase in New Zealand, as there are superior grasses equally adapted for wet situations, which will better repay the expense attending aided propagation.

*Glyceria fluitans*, R. Brown, can be recommended as a valuable grass for wet land. This exotic species is already not uncommon in several parts of New Zealand, and the following comparative values of it with *Alopecurus geniculatus* may prove interesting. They are taken from the Woburn experiments of Mr. Sinclair, see "Hortus Gramineus Woburnensis," pp. 349, 353:—

"*Alopecurus geniculatus*: The produce per acre was 6806 lb., which, when dry, amounted to 2892 lb., and, on analysis, yielded of nutrient matter 292 lb."

"*Glyceria fluitans*: The produce per acre was 13,612 lb., which, when dry, amounted to 4083 lb., and, on analysis, yielded of nutrient matter 372 lb." Cows eat this grass greedily near Wellington, and give more milk when fed upon it.

*Glyceria aquatica* is also a most valuable grass in wet places, and worthy of introduction to New Zealand, as the following analysis from the Woburn experiments prove:—

"*Glyceria aquatica*: The produce per acre was 126,596 lb., which, when dry, amounted to 75,957 lb., and, on analysis, yielded of nutrient matter 4945 lb. At the time of flowering the produce contains more nutrient matter than when the seed is ripe, in the proportion of 19 to 17. In the fens of Cambridgeshire and Lincolnshire immense tracts are covered by this grass, which not only affords rich pasturage in summer, but forms the chief part of the winter fodder."

The best method of propagating these grasses will probably be by the roots, as the only species yet introduced does not always ripen its seed. It also shows a capacity for growing on dry ground, and may, therefore, prove valuable on the farm in mixed fodder crops.

DISTRIBUTION IN NEW ZEALAND: NORTH ISLAND: EAST COAST—Colenso; AUCKLAND—Kirk; KAWAU (probably introduced)—Buchanan. SOUTH ISLAND: NELSON (Sub-alpine)—H. H. Travers; CANTERBURY—Lyall, Armstrong; LAKE OHAU—Haast; OTAGO LAKE DISTRICT (Sub-alpine)—Hector and Buchanan.

Reference to Plate V.: Fig. 1. Plant. 2. Spikelet. 3. Floret. 4. Nervation of empty glumes. 5. Nervation of flowering glume. 6. Ovary with long feathery stigmas.

Alopecurus geniculatus, *Linn.*

Order GRAMINEÆ.

## GENUS IV.—HIEROCHLOE, Gmelin.

*Spikelets* panicled, large, broad, pedicelled, laterally compressed, shining, 3-flowered, two lower staminiferous, upper fertile. *Empty glumes* subequal, keeled, obtuse, or acute. *Flowering glumes* similar, awnless, or with a terminal or dorsal short awn. *Palea* 1 or 2-nerved. *Scales* 2. *Stamens* 2—3. *Grain* terete, free. DISTRIBUTION OF GENUS: COLD CLIMATES OF BOTH HEMISPHERES. *Etymology*: Named from two Greek words meaning "sacred grass."

ARRANGEMENT OF THE SPECIES:—

I.—*Outer glumes as long as the flowering.*
Culms 2—4 feet. Leaves long ... ... 1. *H. redolens.*
Culms 1—2 feet. Leaves short ... ... 2. *H. alpina.*
II.—*Outer glumes much longer than the flowering* ... 3. *H. brunonis.*

## 1.—HIEROCHLOE REDOLENS.

**SWEET-SCENTED SACRED GRASS.**

*(Plate VI.)*

HOLEUS REDOLENS, Forst. Prod. 92; MELICA MAGELLANICA, Desv. in Lam. Dict., IV., 72. HIEROCHLOE ANTARCTICA, R. Brown, Prod. 209; Brongn. in Duperr., Voy. t. 23; Kunth, Rev. Gram. t. 203. DISARRHENA ANTARCTICUM, Labill. Fl. Nov. Holl., II., 83, t. 232. TORRESIA REDOLENS, A. Cunn. HIEROCHLOE REDOLENS, R. Brown. Hook. fil., Fl. Tasm. II., 108; Fl. N.Z., I., 300; Handb. N.Z. Flora, I., 321.

A BEAUTIFUL sweet-scented grass, ascending to 3000 feet altitude. *Flowers* December—February. Perennial. *Root-fibres* few, wiry. *Stems* 2—4 feet high. *Leaves* flat, smooth, or slightly scabrid; *ligule* broad, membranous. *Panicle* effuse, 6—12 inches long, nodding, shining brown, branches capillary, slightly hairy, lower 2—3 inches long; *ligule* long or short, obtuse, serrate. *Spikelets* numerous, ¼-inch long and

broad, pale, shining. *Empty glumes* ovate, acute, 3-nerved; two lower flowering glumes (staminiferous) obtuse, bearded below, downy above, margins with long cilia, 5-nerved, shortly awned below the top. *Palea* (staminiferous) bifid, 2-nerved. Upper flowering glume (fertile) obtuse, 5-nerved, very shortly awned. *Palea* (fertile, obtuse, 2-nerved, seldom 1-nerved. *Scales* oblong-lanceolate, of the lower florets bifid, and of the upper floret acute; the two scales are sometimes united as one by the margins at bottom, and appearing as a 2-lobed scale. *Stamens* 2—3. *Anthers*, long, stout. *Ovary* glabrous. *Styles* shorter than the *stigmas*, nearly connate at the base. *Stigmas* long, narrow, feathery. *Grain* ovate-oblong. DISTRIBUTION OF SPECIES: CAMPBELL ISLAND, FALKLAND ISLANDS, TERRA DEL FUEGIA, TASMANIA, ALPS OF SOUTH WEST AUSTRALIA, NEW ZEALAND.

This grass is widely distributed over the Islands in wet places. It was, some years ago, found abundantly in Otago and Southland, from the sea-level to 3000 feet altitude. When found at low altitudes it is always larger and coarser than when under sub-alpine influences. It is often found growing luxuriantly among sand-hills near the sea, where its long wiry roots penetrate to a considerable depth in the soil. It is, apparently, a soda-loving plant, being partial to littoral swamps, where, in such places, it often attains four feet in height, the large graceful plume-like panicles forming conspicuous objects, and emitting, in warm weather, a strong perfume. When found in upland pastures it is of much smaller size, and more succulent, forming a valuable component of the pasture, and eaten by cattle and sheep with apparent relish. This grass, with many others, has suffered much in the South Island in the general deterioration of the pasture during the last fifteen years; and, although its deep-seated roots might have enabled it to resist the effects of repeated burnings, yet, where burning has been combined with over-feeding, it has nearly been destroyed. It is probable that this grass has been somewhat over-rated as regards its nutrient qualities, but it would be an impossible task to lay down a constant value for any grass, as this must continually vary, according to the different conditions in which it is placed as regards soil, moisture, and heat.

In sub-alpine situations, both in New Zealand and in Australia, the settlers do not recognize much difference between this species and *H. alpina*; and in such situations the value of both in pasture is nearly equal, neither being considered as a first-class grass.

Reference to Plate VI.: Fig. 1. Plant. 2. Spikelet. 3. Florets with the empty glumes removed. 4, 4'. Nervation of empty glumes. 5. Nervation of staminiferous flowering glumes. 6. Nervation of staminiferous Palea. 7. Nervation of fertile flowering glume. 8. Nervation of fertile Palea. 9. Scale of staminiferous floret. 10. Scale of fertile floret. 11. Ovary. 12. Grain.

Hierochloe redolens. *Br.*

Order GRAMINEÆ.

## 2.—HIEROCHLOE ALPINA.

### THE HOLY GRASS.

*(Plate VII.)*

HIEROCHLOE BOREALIS, Schrœder. HOLCUS ODORATUS, Linnæus. HIEROCHLOE ODORATA, Koch. HIEROCHLOE FRASERI, Hook. fil. Fl. Ant. I., 93. HIEROCHLOE REDOLENS, R. Brown, var. Fraseri, Benth. Fl. Austral. VII., 559. HIEROCHLOE BOREALIS, Rœm. and Schultes. Hook. fil., N.Z., I., 300; Fl. Tasm., II., 108. HIEROCHLOE ALPINA, Rœm. and Schultes. Hook. fil., Handb. N.Z. Flora., I., 322.

A SLENDER sub-alpine grass, ascending to 3,500 feet. *Flowers* December—February. Perennial. *Roots* fibrous, creeping. *Stems* 1—2 feet high. *Leaves* 4—8 inches long, smooth, flat; *ligule* long or short, obtuse, serrate. *Panicle* ovate, 2—4 inches long, branches few, capillary. *Spikelets* ¼-inch long and broad, shining. *Empty glumes* large, acute or slightly obtuse, 3-nerved. *Flowering glume* pubescent, margins long-ciliate, 5-nerved; awn variable in length and position, usually inserted above the middle in the staminiferous, and in the fertile floret very short and terminal. *Palea* obtuse, 2-nerved in the staminiferous florets, and 1-nerved in the fertile. *Scales* narrow-lanceolate, ciliate and bifid at top, and often united as one by the lower margins on one side only. *Stamens* 3. *Anthers* long. *Ovary* glabrous, narrow, acute. *Styles* short, connate at the base. *Stigmas* penicillate. *Grain* oblong-ovate, narrowed at both ends. DISTRIBUTION OF SPECIES: SCOTLAND, NORWAY, SWEDEN, LAPLAND, ICELAND, ITALY, FRANCE, GERMANY, KAMTSCHATKA, ALASKA, AUSTRALIA, TASMANIA, NEW ZEALAND.

**This species, according to Sir J. Hooker, is identical with H. borealis, or the "Holy Grass" of the Northern Hemisphere. It is very sweet scented, the odour being very similar to that of the previous species. Much historical interest is attached to this species in some parts of Europe, from a long-prevailing custom of strewing it before churches on certain festivals. In Sweden it is hung over beds,**

in the belief that it induces sleep; and in Iceland it it used to scent the clothes and apartments of the inhabitants. According to Cuthbert W. Johnson, its nutritive qualities are greater than in most of the early spring grasses; but, from the paucity of its foliage, it cannot be recommended in agriculture. From this opinion it may be concluded that this species will be valuable in the sub-alpine pastures of New Zealand as an early and nutritious food, and, from its small growth, be well adapted for sheep. DISTRIBUTION IN NEW ZEALAND: NORTH ISLAND: RUAHINE MOUNTAINS—Colenso. SOUTH ISLAND: NELSON —Monro, Travers; HOPKINS RIVER, 2000—3500 feet altitude—Haast; OTAGO LAKE DISTRICTS, 3000 feet altitude—Hector and Buchanan.

Reference to Plate VII.: Fig. 1. Plant. 2. Spikelet. 3. Florets with empty glumes removed. 4, 4'. Nervation of empty glumes. 5. Nervation of staminiferous flowering glumes. 6. Nervation of Palea (staminiferous). 7. Nervation of fertile flowering glume. 8. Nervation of Palea (fertile). 9. Scales (staminiferous florets). 10. Scale (fertile floret). 11. Ovary.

Hierochloe alpina, *Rœm. and Schultes.*

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## Order GRAMINEÆ.

### GENUS V.—SPINIFEX, Linnæus.

INFLORESCENCE dicœcious. Male *spikelets* spiked on rigid peduncles, which are collected into umbels, with sheathing or spathaceous leaves at their base, 1 or 2-flowered. *Empty glumes* 3. *Flowering glume* membranous. *Stamens* 3. *Anthers* very long. Female *spikelets* solitary or few, in the sheathing bases of very long, pungent leaves, which are extremely numerous, and collected into very large globose masses, 1 or 2-flowered; 3 *empty glumes*, as in the male, but larger. *Flowering glume* coriaceous. *Scales* 2. *Grain* free within the glumes and palea. DISTRIBUTION OF GENUS: INDIA, CHINA, AUSTRALIA, TASMANIA, PACIFIC ISLANDS, NEW ZEALAND. *Etymology*: From the Latin "Spina," in allusion to the termination of the *rachis*.

## SPINIFEX HIRSUTUS.

**SPINY ROLLING GRASS.**

*(Plates VIII., IX.)*

SPINIFEX HIRSUTUS, Labill. Flora, Nov. Holl., II., 81, t. 230—231. SPINIFEX SERICEUS, Raoul. En. Plant. SPINIFEX INERMIS, Banks et Sol., M.S.S. IXALUM INERME, Forst., Prodr., fid. Raoul. SPINIFEX HIRSUTUS, Labill. Hook. fil., Fl. Tasm. II., 106; Fl. N.Z., I., 292; Handb. N.Z., Flora, I., 322.

A COURSE, rambling, much-branched, rigid, spinous, silky or woolly, perennial grass. Habitats near the sea on sand-hills, or saline soils more inland. *Flowers* January—February. *Culms* stout, knotted, creeping. *Leaves* 1—1½-inches long, coriaceous, lower sheaths shining, both sides of leaf silky, or villous. Male spikes with the *rachis* 1—3 inches long, numerous, peduncled, silky. *Spikelets* 1—2-flowered, shortly pedicelled, ⅓-inch long *Empty glumes*: First and second 7-nerved, third 5-nerved. Androus *flowering glume* 5-nerved. *Palea* 2-nerved. *Scales* 2, large, fleshy, with membranous borders, 2-nerved. *Stamens* 3. *Anthers* long, narrow. Female *spikelets* 1—2-flowered at

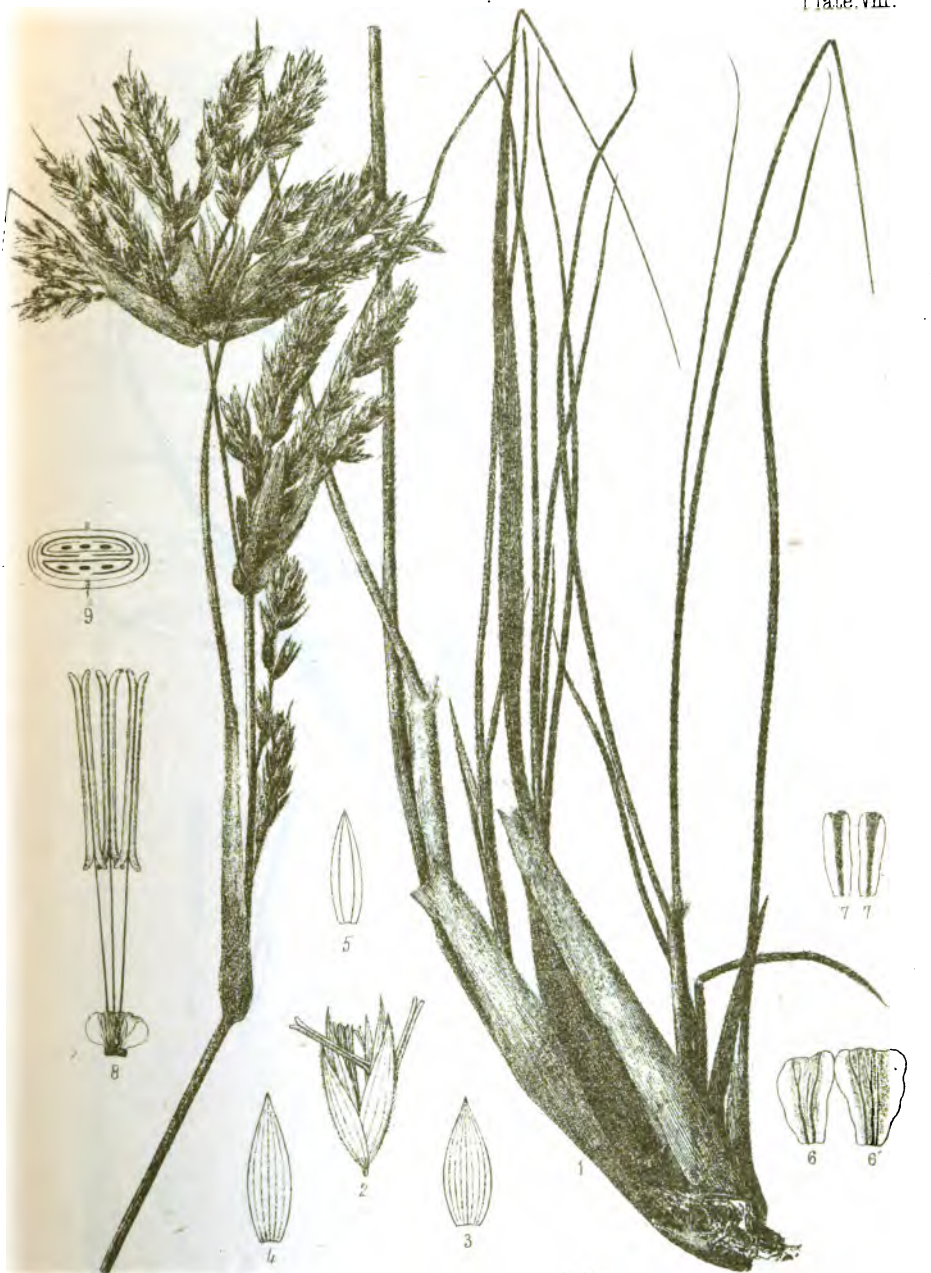
the membranous basis of leaves, which terminate in rigid, slender spines, 3—8 inches long. *Empty glumes*: First shortly awned, 9-nerved; second shortly awned, 7-nerved; third 5-nerved. *Flowering glume* 7 nerved. *Palea* 4-nerved. *Scales* 2, large, fleshy, with membranous borders, 2-lobed, and 2-nerved. *Ovary* compressed. *Stamens* 3, abortive. *Styles* very short, connate at the base. *Stigmas* very long, with short simple hairs. DISTRIBUTION OF SPECIES: INDIA, PACIFIC ISLANDS, AUSTRALIA, TASMANIA, NEW ZEALAND.

The present grass has no claim whatever as a food-plant for stock, and can only be recommended as a sand-binder in fixing drift sands when encroaching on valuable land. For this purpose it deserves more attention than has hitherto been bestowed upon it. It is a plant of comparatively rapid growth, and with the aid of other indigenous plants, such as *Desmoschœnus spiralis*, of similar habit, would give effectual aid in checking the inroads of wind-driven sand, conditionally that the plants be carefully conserved from fire. From the ravages of this element alone, since the settlement of New Zealand, may be ascribed the increased spread of wind-driven sand, and, under such inflictions, the indigenous plants are overlooked in reclothing the sand dunes with vegetation, seed of exotic plants inferior for this purpose being often imported at considerable expense.

This grass may be propagated by seed, as also by roots; the seed may be collected in February March, and April. It is probable, however, that the trouble incurred in collecting native grass seed, when compared with the ease with which exotic seed may be procured by purchase, will account for the neglect of such valuable sand-binders as the grass under notice. DISTRIBUTION IN NEW ZEALAND; COMMON ON THE COASTS EVERYWHERE.

Reference to Plate VIII.: Fig. 1. Male Plant. 2. Spikelet. 3. Nervation of first and second empty glumes. 4. Nervation of third empty glume and flowering glume. 5. Nervation of Palea. 6, 6′. Scales of lower Palea. 7, 7′. Scales of upper Palea. 8. Variety of scales with stamens. 9. Diagram showing the arrangement of the glumes in floret, in which the third empty glume holds the position of flowering glume to the upper Palea, and may be considered as a flowering glume.

Reference to Plate IX.: Fig. 1. Female Plant. 2. Spikelet. 3. Nervation of first empty glume. 4. Nervation of second empty glume. 5. Nervation of third empty glume. 6. Nervation of flowering glume, 7. Nervation of Palea. 8, 8′. Scales. 9, 9′. Ovary, with three abortive stamens, and long stigmas. 10. Grain.




Spinifex hirsutus, *Labill.*
MALE

Spinifex hirsutus. *Labill.*
FEMALE.

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## Order GRAMINEÆ.

### GENUS VI.—PASPALUM, Linnæus.

*Spikelets* in the New Zealand species ovoid, much compressed, arranged in two rows on one side of a flat *rachis*, 1-flowered, short, acute, or obtuse, without a callus at the base. *Empty glumes* 2—3, unequal; lower glume usually very small. *Flowering glume* hardening, and enclosing the palea and grain; all obtuse or acute, awnless. *Scales* 2, short, fleshy. *Stamens* 3. *Grain* free within the hardened glume. DISTRIBUTION OF GENUS: EAST INDIES, WEST INDIES, NORTH AMERICA, PERU, WEST AFRICA, AUSTRALIA, NEW ZEALAND. *Etymology*: One of the Greek names for "Millet."

ARRANGEMENT OF THE SPECIES:—

Erect. Leaves flat. Spikelets obtuse ... 1. *Paspalum scrobitulatum.*
Creeping. Leaves involute. Spikelets acute 2. *Paspalum distichum.*

## 1.—PASPALUM SCROBITULATUM.

**DITCH MILLET.**

*(Plate X. A.)*

PASPALUM SCROBITULATUM, Trin, Sp., Gram. II., t. 143.; F. Muell., Fragm. VIII., 156. PASPALUM ORBICULARE, Forster, P. POLYSTACHYUM, and P. PUBESCENS. R. Brown, P. METABOLON, Steud. Syn. Glume I., 19. PASPALUM SCROBITULATUM, Linnæus. Hook. fil., Fl. N.Z., I., 291; Handb. N.Z. Flora, I., 323.

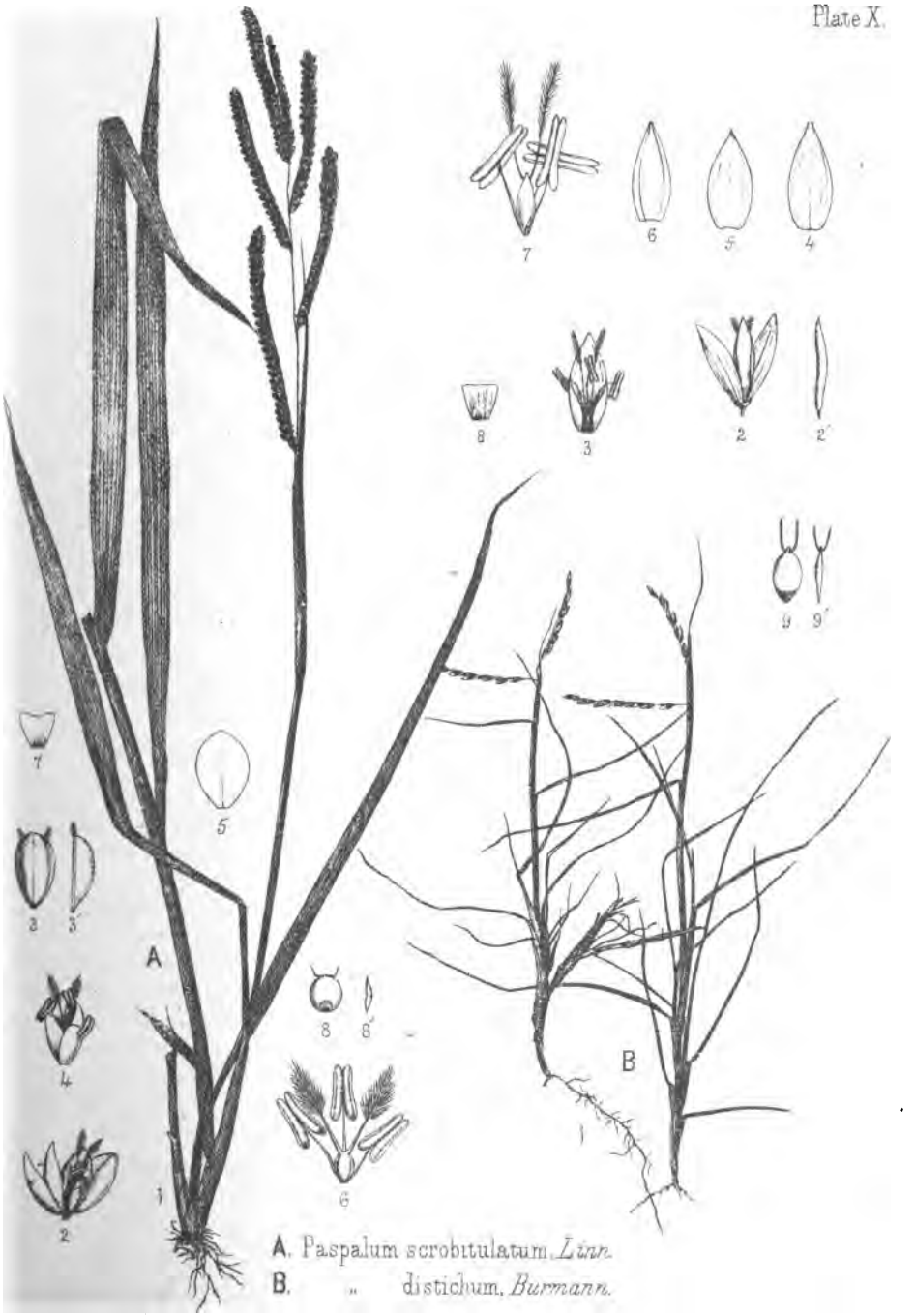
A GLABROUS, erect, dark-brownish-green grass, ranging from the sea-level to 500 feet altitude. *Flowers* December—January. Perennial. *Culms* tufted, 1—3 feet high, often forming small tussacs. *Leaves* broad, flat, or wrinkled, rough at the margin, often hairy at the base; *ligule* short, broad, rounded at top. *Spikes* 2—6, alternate, 1—2 inches long; *rachis* flat, bristly at the base. *Spikelets* imbricate, in two series, sessile, orbicular, $\frac{1}{12}$—$\frac{1}{10}$-inch long. *Empty glumes* 2, membranous, 1-nerved. *Flowering glume* concave, faintly 3-nerved. *Palea* flat, faintly 2-nerved,

*Scales* 2, short, fleshy, truncate. *Stamens* 3, large. *Styles* long. *Stigmas* penicillate, shorter than the styles. *Grain* round, thin, plano-convex, free within the hardened glume and palea. DISTRIBUTION OF SPECIES: EAST INDIES, AUSTRALIA, NEW ZEALAND.

The value of this grass in pasture is probably insignificant, and, therefore, its limited distribution in New Zealand is not much to be regretted. It appears to be chiefly confined to the Auckland District and the Islands to the Eastward. It may be noticed as a reason why this grass should not be cultivated in New Zealand, that this species, or a variety of it, is in very bad repute in the East Indies. Quoting from Lindley's "Vegetable Kingdom," p. 113, "A variety of *Paspalum scrobitulatum*, called 'Hureek' in India (Graham's 'Bombay Plants,' p. 234), which is, perhaps, the Ghohona grass, a reputed Indian poisonous species, is said to render the milk of cows that graze upon it narcotic and drastic." ("Madras Journal," 1837, p. 107.) It does not follow, however, that the same species of any tropical poisonous plant, grown in the temperate climate of New Zealand, would prove equally noxious, as it is well known that the poisonous principle of many plants, such as the opium poppy, is considerably modified by cultivation under a reduced temperature. In New Zealand this species is not much relished by cows, where other grass can be got, therefore its reputed effects on milk, if any, may not be worth consideration. DISTRIBUTION IN NEW ZEALAND: NORTH ISLAND: BAY OF ISLANDS—Banks and Solander; ISTHMUS OF AUCKLAND and GREAT BARRIER ISLAND—Kirk; TITIRANGI—Cheeseman; KAWAU ISLAND—Buchanan.

Reference to Plate X. A: Fig. 1. Plant. 2. Spikelet open. 3,3′. Spikelet closed, front and side view. 4. Palea. 5. Nervation of empty glumes. 6. Ovary with penicillate stigmas and stamens. 7. Scale. 8, 8′. Grain, front and side views.

Specimens of this grass from Victoria have a more slender habit, narrower spikes, and smaller spikelets.


7
6
5
4
8
3
2
2'
9
9'
A
B
1
A. Paspalum scrobitulatum, *Linn.*
B. " distichum, *Burmann.*

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Order GRAMINEÆ.

## 2.—PASPALUM DISTICHUM.

**SEA-SIDE MILLET.**

*(Plate X. B.)*

PASPALUM LITTORALE, R. Brown, Prod. 188; Trin. Spe. Gram. I., t. 112. PASPALUM DISTICHUM, Burmann. Fl. N.Z., I., 291. Handb. N.Z. Flora, I., 323.

A CREEPING, glabrous, littoral grass. *Flowers* December—February. Perennial. *Culms* branched, compressed, ascending; 4—10 inches high, covered with leaf-sheaths to the top. *Leaves* distichous, strict, involute; *ligule* short, broad, rounded at top; mouth of sheath with a tuft of silky hairs on each side. *Spikes* in pairs, 1 inch long; *rachis* narrow. *Spikelets* loosely imbricate, glabrous, pedicelled, ovate, acute, ⅛-inch long. *Empty glumes* 2, membranous, 5-nerved. *Flowering glume* slightly concave, faintly 3-nerved. *Palea* flat, faintly 2-nerved. *Scales* 2, fleshy, truncate. *Styles* long. *Stigmas* feathery, shorter than the style. *Stamens* 3. *Grain* ovate, flat, thin, free within the hardened glume. DISTRIBUTION OF SPECIES: NEW ZEALAND, also a common Tropical and Sub-Tropical Grass.

This is a grass of considerable value, and is commonly found on littoral swamp land, and wet bottoms among sand-hills on the coast-line of Auckland and Islands on the East Coast—localities where superior grasses are seldom found. It is also common in similar situations in Australia, where, according to Mr. Bacchus, "its nutrient properties are considerable, horses and cattle eating it readily." From the fact that this grass supplies valuable food for stock in localities where species of value are never abundantly found, is obtained an argument in favour of its introduction to similar places in other parts of New Zealand, where the climate would permit its growth. At the proper season seed could, no doubt, be collected in sufficient quantity to sow down a few square yards of fenced ground adapted for the purpose, as an experiment, and, if this should prove a failure, inoculation by plants is always possible with grasses which have creeping roots, as in this species.

There are also exotic species of this Genus of great value, which might be introduced with much probability of success in the swamps of the Waikato, or

Isthmus of Auckland; one of these (quoting from "Lindley's Vegetable Kingdom," p. 113), is "*Paspalum exile*, a species common on the West Coast of Africa, and from which a fine-grained corn is gathered and sold there under the name of Fundi."

This species would, in addition to improving the pasture, furnish a large food-supply for native wild fowl and introduced game birds, the millets being often sown in copses in England for that purpose. DISTRIBUTION IN NEW ZEALAND: NORTH ISLAND: BAY OF ISLANDS—Cunningham; AUCKLAND—Sinclair; WAIKATO and GREAT BARRIER ISLAND—Kirk; TITIRANGI—Cheeseman; KAWAU—Buchanan.

Reference to Plate X. B: Fig. 1. Plant. 2, 2'. Spikelet open and closed. 3. Palea with feathery stigmas and stamens. 4. Nervation of empty glumes. 5. Nervation of flowering glume. 6. Nervation of Palea. 7, Ovary with feathery stigmas and stamens. 8. Scale. 9, 9'. Grain, front and side views.

## Order GRAMINEÆ.

### GENUS VII.—PANICUM, Linnæus.

*Spikelets* variously arranged, naked, or with bristles at their base; spiked, racemed or panicled; 1-flowered, or, if 2-flowered, the lower male. *Glumes* 4, awned or awnless; lowest small or minute, empty; second larger, empty; third empty, or male-flowered, uppermost with a hermaphrodite flower, fainter-nerved, smooth, hardening and enclosing the palea and grain. *Palea* like the glume, but smaller, 2-nerved. *Scales* 2, truncate. *Stamens* 3. *Grain* free. DISTRIBUTION OF GENUS: TROPICAL AND SUB-TROPICAL CLIMATES. *Etymology;* From the Latin name "Panis" (Bread).

## 1.—PANICUM IMBECILLE.

**SLENDER PANICK GRASS.**

*(Plate XI.)*

OPLISMENUS SETARIOUS, Rœm and Schult; Kunth. Enum. I., 139. Benth Fl. Austral. VII. ORTHOPOGON ÆMULUS, R. Brown, Prod. 194. HEKATEROSACHNE ELATIOR, Steudel. OPLISMENUS ÆMULUS, Kunth. Hook. fil., Fl. N.Z., I., 291. PANICUM IMBECILLE, Trinius. Hook. fil. Handb. N.Z. Flora, I., 323.

A WEAK, slender, decumbent grass, rooting at the nodes, culms erect, 6—18 inches long, sparingly branched, ascending to 1000—1500 feet altitude. *Flowers* December—February. Perennial. *Leaves* 1—6 inches long, ¼—1 inch broad, lanceolate; sheaths of leaves and knots of culms more or less pilose. *Spikelets* spiked, in distant clusters of 2—6, nearly sessile, 1½-inch long, glabrous or pilose, naked, or with a brush of hairs at base. *Empty glumes* 3, often pilose on the back, membranous; first *empty glume* shortest, 3-nerved, and with a long flexuose, stout, obtuse awn; second *empty glume* larger, sharply acute, 5-nerved, and with a very short awn; third *empty glume* acute, 7-nerved.

*Flowering glume* obtuse, coriaceous, white, 2-nerved. *Scales* 2, truncate or bilobate. *Ovary* glabrous. *Styles* long. *Stigmas* shorter, penicillate. *Grain* linear. DISTRIBUTION OF SPECIES; TROPICS OF ASIA, AFRICA, AND AMERICA; AUSTRALIA, NEW ZEALAND.

A sparse foliaged grass, not adapted for pasture, its usual habitat being under the shelter of bush. It may be termed an unsocial grass, as it is most commonly found growing in isolated patches, and it probably could not exist under a struggle for place with grasses of more robust habit on open land. Cattle eat this grass readily, but their relish for it must be greatly lessened by the large amount of foreign matter, such as dead leaves, with which it is usually associated; it may, therefore, be classed with other bush grasses, such as *Microlæna avenacea*, as an auxiliary to supplement neighbouring pastures during dry seasons.

This grass is the only representative in New Zealand of the genus *Panicum*, a family containing several species of the greatest value, as corn and fodder plants, such as *Panicum frumentaceum*, cultivated in India as a corn plant, and *Panicum spectabile*, indigenous to Brazil, and valuable as a permanent summer grass, the latter being highly recommended as adapted to the temperate climate of New Zealand. Experiments with this grass in Australia prove its capacity to resist the driest seasons, which is pointed out by Dr. Schomburg in his paper on introduced grasses, read before the Chamber of Manufactures, Adelaide, and also as the result of experiments by Dr. Curl, of Rangitikei, in relation to its value in pasture. (Trans. N.Z. Institute, Vol. IX., page 531.)

Regarding the capacity of grasses to resist drought, it may be accepted as a rule in the improvement of pastures that the permanence of every grass will be in exact proportion to the stoutness of its roots, and depth to which they extend. Species with deep-seated, stout roots, like *Panicum spectabile* and *Sporobilis elongatus*, will be enabled to resist the driest seasons; whilst species such as *Lolium perenne*, and *Dichelachne crinita*, having fine fibrous roots ramifying near the surface, must inevitably perish under the same circumstances. DISTRIBUTION IN NEW ZEALAND: NORTH ISLAND: COMMON IN WOODS—Banks and Solander; AUCKLAND ISTHMUS, GREAT BARRIER ISLAND, THAMES —Kirk; TITIRANGI—Cheeseman; KAWAU ISLAND, WELLINGTON—Buchanan. SOUTH ISLAND: NELSON—Travers; CANTERBURY—Lyell and Armstrong.

Reference to Plate VII.: Fig. 1. Plant. 2. Spikelet. 3. Nervation of first empty glume. 4. Nervation of second empty glume. 5. Nervation of third empty glume. 6. Nervation of flowering glume. 7. Nervation of Palea. 8, 8'. Scales. 9. Ovary with stamens and penicillate stigmas. 10. Grain.

Panicum imbecille, *Trinius.*

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Order GRAMINEÆ.

GENUS VIII.—ISACHNE, Brown.

*Spikelets* panicled, 2-flowered, lower flower usually male, upper hermaphrodite. *Empty glumes* 2, nearly equal, often deciduous. *Flowering glumes* nearly equal, the fertile glume hardening and including the palea and grain. *Palea* nearly as large as the glumes, also hardening. *Scales* 2. *Stamens* 3. *Ovary* linear. *Grain* free within the hardened glume and palea. DISTRIBUTION OF GENUS: TROPICAL AND SUB-TROPICAL CLIMATES. *Etymology*, from two Greek words signifying "equal" and a "glume."

## 1.—ISACHNE AUSTRALIS.

**EQUAL-GLUMED MILLET.**

*(Plate XII.)*

PANICUM ATROVIRENS, Trin.; Kunth, Enum. I., 127; F. Muell. Fragm. VIII., 193. PANICUM ANTIPODUM, Spreng. Syst. I., 314. ISACHNE AUSTRALIS, R. Brown. Hook. fil., Fl. N.Z., I., 291; Handb. N.Z. Flora, I., 324.

A TUFTED grass, usually on swampy land. *Flowers* December—January. Perennial. *Root* fibrous. *Stems* 6—18 inches high; slender, decumbent, and creeping at the base. *Leaves* scaberulous, 3—5 inches long, ⅛—¼-inch broad, flat; mouth of the sheath with silky hairs. *Panicle* erect, ovoid, 1—2 inches long, lax, branches long, flexuous, sparingly divided. *Spikelets* few, pedicelled, obtuse, ½-inch long. *Empty glumes* glabrous, 11- and 9-nerved. *Flowering glumes:* lower, sessile, glabrous, 5-nerved, *Palea* 2-nerved; upper, stipitate, pubescent, 5-nerved, *Palea* 2-nerved. *Scales* truncate. *Anthers* large. *Ovary* glabrous. *Styles* very long. *Stigmas* penicillate, shorter than the styles. DISTRIBUTION OF SPECIES: INDIA, CHINA, AUSTRALIA, NEW ZEALAND.

Little is known of this grass in New Zealand, except in the District of Auckland, where, according to Kirk, it is abundant in swampy places, and is

greedily eaten by all kinds of stock. So valuable a grass is worthy of attention by settlers, and, although it might not thrive in the colder parts of the colony, it could, no doubt, be extended over a larger area of the North Island than that to which it is at present restricted. Many of our most valuable indigenous grasses have a very limited distribution, while their cultivation is much neglected, a preference being given to exotic species, apparently from the greater facility with which their seed can be procured by purchase. The difficulty in procuring seeds of our native grasses will not be overcome until a few enterprising settlers commence their cultivation chiefly for the sale of seed, which would certainly prove remunerative. DISTRIBUTION IN NEW ZEALAND: NORTH ISLAND, BAY OF ISLANDS—A. Cunningham; AUCKLAND—Sinclair; LAKE TAUPO—Colenso; ISTHMUS OF AUCKLAND, THAMES, NORTH CAPE to WAIKATO, &c.—Kirk.

Reference to Plate XII.: Fig. 1. Plant. 2. Spikelet. 3. Staminiferous floret. 4. Fertile floret. 5. Palea of fertile floret. 6, 6′. Nervation of empty glumes. 7. Nervation of flowering glumes. 8. Nervation of Palea. 9. Scales. 10. Ovary, &c.

Isachne australis, *Br.*

LIBRARY OF
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Order GRAMINEÆ.

GENUS IX.—ZOYSIA, Willdenow.

*Spikelets* few (1—10), sessile, or shortly pedicelled, alternate, and imbricating on a stiff, erect, flattened flexuous rachis. *Empty glume* 1, mucronate or awned. *Flowering glume* solitary, included. *Palea* membranous or none. *Scales* 0. *Stamens* 3. *Ovary* oblong. *Styles* short, terminal. *Stigmas* long, feathery. *Grain* free. DISTRIBUTION OF GENUS: INDIA, MAURITIUS, CHINA, AUSTRALIA, NEW ZEALAND. *Etymology*: Named in honor of Baron Charles de Zoys, a Carniolian ecclesiastic, and collector of plants.

## 1.—ZOYSIA PUNGENS.

*(Plate XIII. A.)*

ZOYSIA PUNGENS, Willd.; R. Brown, Prod. 208; F. Muell, Fragm. VIII. 116; Benth. Fl. Hongk. 418. ROTTBOELLIA UNIFLORA, A. Cunningham. ZOYSIA PUNGENS. Willdenow. Hook. fil. Fl. N.Z., I., 312; Handb. N.Z. Flora, I., 324.

A SMALL, creeping, rigid, usually littoral grass. *Culms* branched, 1—3 inches high, tufted, glabrous. *Flowers* December—January. Perennial. *Roots* wiry, striking downwards from the prostrate rhizome. *Leaves* erect or spreading, filiform or subulate, involute, 1—4 inches long; sheaths tumid, grooved; *ligule* 0. *Spike* $\frac{1}{8}$—$\frac{1}{2}$-inch long, often reduced to a solitary spikelet. *Spikelets* $\frac{1}{10}$—$\frac{1}{3}$-inch long, shortly pedicelled. *Empty glume* ovoid, convolute, rigid, very coriaceous, glabrous, tip produced to a short awn, 7-nerved. *Flowering glume* solitary, sessile, included, membranous, convolute, 1-nerved. *Palea* 0. *Stamens* 3, large. *Ovary* sessile, glabrous. *Grain* long, narrow. DISTRIBUTION OF SPECIES: THE SAME AS THE GENUS.

A grass of considerable value on littoral swamps and dry flats near the sea. According to Kirk, "It is found sometimes forming a compact turf on dry land, and affording a large supply of succulent herbage for horses, cattle, and sheep."

Its value, however, in such localities, if bulkier grasses would grow there, must be comparatively little, as, from its close-growing habit, it chokes out all other species. This may be observed near Tauranga, where, on the dry littoral flats above high water, the constant cropping of this grass by horses and cattle has formed so close a turf as to be impervious to all other vegetation. It is evidently much relished by stock, and is worthy of introduction in sand-hill districts near the sea, or saline soil inland, of little value for other herbage, as it would clothe the wet flats with a valuable sward. This is another of those grasses, similar to *Paspalum distichum*, which will be easiest propagated by roots, the close-matted wiry fibres forming coherent masses of turf, which are easily conveyed in fragments to a distance without injury. DISTRIBUTION IN NEW ZEALAND: NORTH ISLAND: BAY ON ISLANDS—Sinclair: WAIKATO, MAKETU, AND LAKE DISTRICT—Kirk; TITIRANGI—Cheeseman; TAURANGA—Buchanan. SOUTH ISLAND: NELSON—Monro; CANTERBURY—Armstrong.

Reference to Plate XIII. A.: Fig. 1. Plant. 2. Spikelet. 3. Floret. 4. Nervation of empty glume. 5. Nervation of flowering glume. 6. Ovary with feathery stigmas. 7, 7′. Grain, front and side views.

**A.** Zoysia pungens, *Willdenow.*
**B.** Echinopogon ovatus, *Palisot.*

Order GRAMINEÆ.

GENUS X.— ECHINOPOGON, Palisot.

*Spikelets* sub-sessile, on short branches closely arranged into an oblong or ovoid, dense spike-like panicle, ½—1½-inches long, bristling with rigid spreading awns, 1-flowered. *Empty glumes* 2, equal. *Flowering glume* as long as the empty, with a pencil of silky hairs at the base; awn terminal. *Palea* nearly equal in length to the flowering glume, with a short stiff pedicel at the base. *Scales* 2. *Stamens* 3. *Ovary* bearded at the top. *Grain* free. DISTRIBUTION OF GENUS: AUSTRALIA, TASMANIA, NORFOLK ISLAND, NEW ZEALAND. *Etymology;* Named from two Greek words meaning "scabrid" and a beard.

## 1.—ECHINOPOGON OVATUS.

**ROUGH-BEARDED GRASS.**

*(Plate XIII. B.)*

AGROSTIS OVATA, Forster. Labill., Fl. Nov. Holl., I., 19, t. 21; CINNA OVATA, Kunth, Enum. I., 208; F. Muell. Fragm. VIII., 106; ECHINOPOGON SIEBERI, Steud. Syn. Glum. I., 183. HYSTERICINA ALOPECURIOIDES, Steudel. ECHINOPOGON OVATUS, Palisot. Hook. fil., Fl. Tasm. II. 117; Fl. N.Z., I., 297; Handb. N.Z. Flora, I., 325.

A HARSH scabrid grass, 6—24 inches high, ascending to 3000 feet altitude. Annual. *Flowers* November—January. *Leaves* scabrid on the edges. Sheath of upper leaf long; *ligule* short. *Spikelets* green, nearly horizontal, 1-flowered. *Empty glumes* equal, rigid, acuminate, 1-nerved. *Flowering glume* with a pencil of silky hairs at the base, 2-fid at the top, 3-nerved; awn terminal, long, rigid, not twisted, involute, flattening out when wet and pressed, as if a continuation of the glume. *Palea* nearly as long as the flowering glume, 1-nerved, and with a short stiff pedicel at the base. *Scales* 2, ovate-lanceolate. *Anthers* large. *Ovary* bearded on top. *Styles* short. *Stigmas* long, feathery. *Grain* long, narrow. DISTRIBUTION OF SPECIES: SAME AS THE GENUS.

A grass widely distributed throughout the Islands, but never found abundant anywhere. It is eaten by sheep and cattle, but is of little value from its harsh non-succulent foliage and straggling habit. Commonly found on dry banks and other waste places, it can only be recommended as an early grass, but would probably not repay cultivation. DISTRIBUTION IN NEW ZEALAND: COMMON IN NORTH AND SOUTH ISLANDS.

Reference to Plate XII. B.: Fig. 1. Plant. 2. Spikelet. 3. Floret. 4. Nervation of empty glumes. 5. Nervation of flowering glume. 6. Nervation of Palea. 7. Scale. 8. Ovary with feathery stigmas. 9. Grain.

## Order GRAMINEÆ.

### GENUS XI.—DICHELACHNE, Endlicher.

*Spikelets* long, narrow, 1-flowered, shining. *Empty glumes* 2, membranous, acuminate. *Flowering glume* as long, on a bearded pedicel, scabrid or silky, 2-fid, or entire at the tip, with a straight, twisted, or flexuose awn from the back or between the lobes, which is not jointed or thickened at the base. *Palea* shorter, linear, 2-fid. *Scales* 2. *Stamens* 3. *Grain* long, terete, free. DISTRIBUTION OF GENUS: AUSTRALIA, NORFOLK ISLAND, TASMANIA, NEW ZEALAND. *Etymology:* From two Greek words signifying a "cloven hoof" and "chaff," in allusion to the bifid Palea.

ARRANGEMENT OF THE SPECIES:—

| | | | |
|---|---|---|---|
| Perennial. | Culms stout. 1—3 feet high. | Spikelets $\frac{1}{2}$—$\frac{3}{4}$-inch long | 1. *D. stipoides.* |
| Annual. | Culms slender. Panicle dense. | Spikelets $\frac{1}{3}$-inch long | 2. *D. crinita.* |
| Annual. | Culms slender. Panicle lax. | Spikelets $\frac{1}{4}$-inch long | 3. *D. sciurea.* |

## 1.—DICHELACHNE STIPOIDES.

**WIRY DICHELACHNE.**

*(Plate XIV.)*

STIPA TERETIFOLIA, Steud. Bentham Flora Australiensis, Vol. VII., 567. AGROSTIS RIGIDA, A. Richard. DICHELACHNE RIGIDA, Steudel. DICHELACHNE STIPOIDES, Hook. fil. Flora. N.Z., I., 294, t. 66. Flora, Tasm., II., 112. Handb. N.Z. Flora, I., 325.

A DENSELY-TUFTED or tussac grass, its habitat being near the sea, on banks or rocks. Perennial. *Flowers* December—January. *Culms*

1—3 feet high, wiry, smooth. *Leaves* longer than the culms, very slender, erect, involute. *Panicle* strict, erect, 4—6 inches long, branches few, short, erect. *Spikelets* ⅓—½-inch long. *Empty glumes* membranous, ½—¾-inch long, narrow, lanceolate, acuminate, 3-nerved. *Flowering glume* shorter, bifid, covered with silky spreading hairs, 5-nerved; awn flexuose, two and a half times the length of the glume, glabrous. *Palea* narrow, bifid, covered with silky hairs, 2-nerved. *Scales* large. *Anthers* very long, narrow. *Ovary* glabrous. *Styles* short. *Stigmas* plumose. *Grain* long, narrow. DISTRIBUTION OF SPECIES: AUSTRALIA, TASMANIA, NEW ZEALAND.

This grass, which is only found near the sea or saline estuaries, is of little value as food for stock; and, from its very rigid, non-succulent habit, is not likely to be improved by cultivation. It is only grazed by horses and cattle during its flowering and seeding season; and the hard wiry nature of its foliage renders it worthless, either in pasture or as fodder. It might, however, be utilized in the manufacture of paper, as it possesses a strong fibrous structure, and is apparently as well adapted for that purpose as the tussac *Danthonias* of the South Island, the latter, from experiments, having proved to be eminently suited for paper-making. DISTRIBUTION IN NEW ZEALAND: NORTH ISLAND: EAST COAST—Banks and Solander; BAY OF ISLANDS AND AUCKLAND—Sinclair; ISTHMUS OF AUCKLAND, THAMES, WAIKATO, GREAT BARRIER ISLAND—Kirk; TITIRANGI—Cheeseman; KAWAU ISLAND—Buchanan.

Reference to Plate XIV.: Fig. 1. Plant. 2. Spikelet. 3. Floret. 4, 4'. Nervation of empty glumes. 5. Nervation of flowering glume. 6. Palea. 7. Scale. 8. Ovary, scale, stamens, and feathery stigmas.

Dichelachne stipoides, *Hook.fil.*

Order GRAMINEÆ.

## 2.—DICHELACHNE CRINITA.

LONG HAIR PLUME GRASS.

*(Plate XV.)*

DICHELACHNE VULGARIS, Trinius. DICHELACHNE FORSTERIANA, Trinius. MUHLENBERGIA MOLLICOMA, Nees. AGROSTIS CRINITA, R. Brown. Prod. 170. APERA CRINITA, Palisot. ANTHOXANTHUM CRINITUM, Linn. fil. Suppl., 90, Labill. Fl. Nov. Holl., II., 115, t. 263. DICHELACHNE CRINITA, Hook, fil. Fl. Tasm. II., 111. Fl. N.Z. I., 293; Handb. N.Z. Flora, I., 326.

A GLABROUS, downy, or scabrid grass, growing in small tufts, ascending to 3000 feet altitude. *Flowers* November—April. *Root* fibrous. Perennial. *Stems* 1—3 feet high, slender or stout, leafy. *Leaves* flat or involute; *ligule* short, obtuse, entire, or lacerate. *Panicle* elongate, contracted, spike-like, 3—6 inches long, branches nearly hidden by the long awns. *Spikelets* $\frac{1}{3}$-inch long. *Empty glumes* long-acuminate, 3-nerved. *Flowering glume* 2-fid at top, 5-nerved; awn capillary, inserted at the back above the middle, flexuose, not twisted, nearly four times as long as the glume. *Palea* 2-fid, with a short awn, 2-nerved. *Scales* large, oblong, long-acuminate. *Anthers* long. *Ovary* glabrous. *Styles* short, wide apart. *Stigmas* long, plumose. *Grain* long, linear. DISTRIBUTION OF SPECIES; AUSTRALIA, TASMANIA, NEW ZEALAND.

A valuable grass, abundantly distributed throughout the islands, and forming, when in flower, a prominent feature in pasture. As a pasture grass when grown under favourable circumstances, on rich valley bottoms with perennial moisture, it is very succulent, but when on dry clay hills it is harsh and scanty; its nutrient qualities may be admitted, forming as it does a large constituent of pastures famous for fattening stock. As a fodder grass it possesses considerable bulk, and would add much value to a mixed crop of hay. In sheltered situations near Wellington, this species has a very extended period of flowering, as a succession of scattered panicles may generally be found during eight months of the year. This is not, however, a singular circumstance, as some native and introduced species, such as

*Poa annua* and *Danthonia semi-annularis*, may be found flowering during the whole year. A variety of *D. crinita*, figured on Plate XV., Fig. 1′, was collected in the Domain, Wellington, the spike-like panicle of which is more open and the awns purple. This variety may probably prove to be an introduced Australian form. It is a very graceful grass when in flower, and a very different looking plant from the species, but by the details of its inflorescence cannot be distinguished. DISTRIBUTION IN NEW ZEALAND: Everywhere from the North Cape to Stewart Island, from sea-level to 3000 feet altitude.

Reference to Plate XV.: Figs. 1, 1′. Plants. 2. Spikelet. 3. Floret. 4, 4′. Nervation of empty glumes. 5. Nervation of flowering glume. 6. Nervation of Palea. 7. Scales. 8. Ovary. 9. Grain.

Dichelachne crinita. *Hook. fil.*

Order GRAMINEÆ.

## 3.—DICHELACHNE SCIUREA.

**SHORT HAIR PLUME GRASS.**

*(Plate XVI.)*

DICHELACANE SIEBERIANA, and D. VULGARIS, Trinius and Ruprecht; D. MONTANA, Endl. Prod., Fl. Norf., 20. AGROSTIS SCIUREA, R. Brown. Prod. 171; A. RARA, Nees; MUHLENBERGIA SCIUREA, Trin. Gram. Unifl., 193. STIPA MICRANTHA, Nees. DICHELACHNE SCIUREA, Hook. fil. Fl. Tasm. II., 111. Fl. N.Z., I., 294; Handb. N.Z. Flora, I., 326.

A SMALL tufted glabrous grass of low altitudes. *Flowers* December—January. *Root* fibrous. Perennial. *Stems* 1—2 feet high, slender. *Leaves* flat or involute; *ligule* very short, obtuse, entire, or lacerate. *Panicle* elongate, contracted, 3—6 inches long, branches more open and with fewer spikelets than the former. *Spikelets* less than $\frac{1}{4}$-inch long. *Empty glumes* narrow, long-acuminate, 3-nerved. *Flowering glume* as long, 2-fid at top, 5-nerved; awn flexuose, twisted, $2\frac{1}{2}$ times longer than the glume, inserted at the back above the middle. *Palea* narrow, 2-fid, 2-nerved. *Scales* large, oblong, long-acuminate. *Anthers* short, stout. *Ovary* glabrous, oblong. *Styles* very short, nearly connate at the base. *Stigmas* short, plumose. DISTRIBUTION OF SPECIES: AUSTRALIA, TASMANIA, NEW ZEALAND.

A very different looking grass from *D. crinita* in its extreme forms, but connected with that species by intermediate varieties, which, though differing in outward form, cannot be separated by the details of the inflorescence. These varieties are, as far as at present known, limited to the North Island. The three specimens figured in Plate XVI. are: Fig. 1, collected by Mr. Kirk, near Auckland. Fig. 1′ from a specimen collected on the Island of Kawau, which in outward form resembles *D. crinita*, but in microscopical details of inflorescence, agrees entirely with the present species. Fig. 1″ is from a specimen collected in the Domain, Wellington, which appears to be only a small form of the species, or an introduced Australian form. All the varieties are valuable pasture grasses, and, from their slender succulent habit, would become valuable as fodder grasses if cultivated. Regarding the doubtful perennial habit of this and other species, it may be remarked, that under the mild climate which obtains in the North Island

of New Zealand, grasses which under a more rigorous climate would die down annually, possess a continuous growth during nearly the whole year, unless when, owing to a dry season, they flower and seed early, and before forming new stoles or branches at the roots, in which case they inevitably die out if not reproduced by seed. This takes place frequently with perennial Ray grass *(Lolium perrene)*, when it is allowed to flower and seed the first year. DISTRIBUTION IN NEW ZEALAND: NORTH ISLAND, BAY OF ISLANDS, and AUCKLAND—Cunningham, Colenso, Sinclair; THAMES DISTRICT—Kirk; TITIRANGI—Cheeseman; KAWAU ISLAND and WELLINGTON—Buchanan.

Reference to Plate XVI.: Fig. 1. Plant. 2. Spikelet, 3. Floret. 4. Nervation of empty glumes. 5. Nervation of flowering glume. 6. Nervation of Palea. 7. Scale. 8. Ovary. 9. Grain.

Dichelachne sciurea. *Hook. fil.*

NO TEXT
REQUIRED

Order GRAMINEÆ.

## GENUS XII.—APERA, Palisot.

*Spikelets* minute, 1-flowered, in large diffuse panicles. *Empty glumes* 2, nearly equal, longer than the flowering. *Flowering glume* terete, coriaceous, acuminate, and ending in a slender, straight, not twisted awn. *Palea* membranous. *Scales* 2. *Stamens* 1—3. *Grain* terete, enclosed in the hardened glume. DISTRIBUTION OF GENUS: EUROPE, NORTH AMERICA, AUSTRALIA, NEW ZEALAND. *Etymology*: From the Greek, signifying "without mutilation," in reference to the constant presence of the floral awn.

## 1.—APERA ARUNDINACEA.

**NEW ZEALAND WIND GRASS.**

*(Plate XVII.)*

APERA ARUNDINACEA, Palisot. Hook. fil., Fl. N.Z., I., 295, t. 67; Handb. N.Z. Flora, I., 326.

A LARGE, densely-tufted, glabrous, ornamental grass, ascending to 1000 feet. *Flowers* December—January. Perennial. *Culms* slender, rigid, arising from creeping, scaly, rhizomes, 2—5 feet high, branching. *Leaves* coriaceous, narrow, involute, slightly scabrid; sheaths long; *ligule* short, truncate. *Panicle* drooping, 8—16 inches long; pedicels alternate, on the long whorled branches. *Spikelets* $\frac{1}{12}$—$\frac{1}{10}$-inch long, pale, shining. *Empty glume* with a scabrid keel, 3-nerved. *Flowering glume* sessile, on a small glabrous callous, thickened and rough at the top; awn scabrid, deciduous, $\frac{1}{3}$-inch long. *Palea* oblong-linear, acute, 2-nerved. *Scales* linear, acute. *Stamen* 1. *Ovary* shortly pedicelled. *Style* very short. *Stigmas* short, feathery. *Grain* linear, terete, truncate. DISTRIBUTION OF SPECIES: SUB-TROPICAL, EAST AUSTRALIA, NEW ZEALAND.

This graceful, nodding, plume-like grass is not found abundant anywhere in New Zealand. Although scattered over several districts, its wiry knot-jointed culms and hard non-succulent foliage preclude it from ever being recommended as

food for stock ; neither, in an economic point of view, could it, from its sparse distribution, unless cultivated, ever be utilized as a fibre-product in the manufacture of paper, to which it is otherwise well adapted. It can only, therefore, be classed as ornamental ; and, certainly, the whorled arrangement of the primary branches and branchlets on the long slender culms of this New Zealand Wind Grass presents a very beautiful tussac object for the decoration of lawns, banks of streams, or margins of ponds. DISTRIBUTION IN NEW ZEALAND: NORTH ISLAND: CAPE TURNAGAIN—Colenso; WAIRARAPA—Buchanan. SOUTH ISLAND: AKAROA—Raoul; CHRISTCHURCH—Armstrong; DUNEDIN—Buchanan.

Reference to Plate XVII. : Fig. 1. Plant. 2. Spikelet. 3, 4. Nervation of empty glumes. 5. Nervation of flowering glume. 6. Nervation of Palea. 7. Scale. 8. Ovary, stamen, and feathery stigmas.

Apera arundinacea. *Hook.fil*

Order GRAMINEÆ.

GENUS XIII.—SPOROBOLUS, Brown.

*Spikelets* minute, 1-flowered, in spike-like contracted panicles. *Empty glumes* 2, unequal, awnless. *Flowering glume* sessile, awnless. *Palea* large. *Scales* 2. *Stamens* 1—3. *Grain* free, terete, with a lax pericarp. DISTRIBUTION OF GENUS: TROPICAL and SUB-TROPICAL CLIMATES, southern parts of AUSTRALIA, NEW ZEALAND. *Etymology*: From two Greek words meaning "a seed," and "casting forth," from the grain being easily shaken out.

## 1.—SPOROBOLUS ELONGATUS.

**RAT-TAIL, OR CHILIAN GRASS.**

*(Plate XVIII.)*

SPOROBOLIS INDICUS, Benth. Fl. Austral., VII. SPOROBOLUS ELONGATUS, R. Brown. Hook. fil., Fl. N.Z., I., 295; Handb. N.Z. Flora, I., 326.

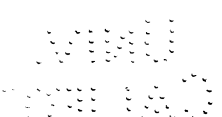
A HARD, wiry, tough, glabrous grass, at low altitudes. *Flowers* November—January. Perennial. *Roots* wiry, fibrous, creeping. *Stem* 1—2 feet high. *Leaves* spreading, flat or involute; *ligule* short, sheaths furrowed. *Panicle* 6—12 inches long, spike-like, much contracted, sometimes lobed below. *Spikelets* pedicelled. *Empty glumes* small, unequal, 1-nerved. *Flowering glume* much larger, oblong-acuminate, 3-nerved. *Palea* oblong-acuminate, 1-nerved. *Scales* narrow, acute. *Ovary* abrupt at top, sessile. *Anthers* stout, short. *Stigmas* nearly sessile, feathery. *Grain* terete, truncate at top, and pointed at base; often found adherent to the mouth of the floret. DISTRIBUTION OF SPECIES: THE SAME AS THE GENUS, probably introduced to New Zealand.

**This grass affords good pasture for horses and cattle, but, from its tough fibrous structure, is not adapted for sheep; and, as it spreads with great rapidity by the roots, it would be injudicious to introduce it on sheep-runs. In the neighbouring Colony of Victoria much ground has been overrun by this grass within the last few years, to the great detriment of the pasture, as it chokes out**

better grasses; and, however nutritious its tough foliage may be, it cannot be eaten in sufficient quantity by sheep, and especially by broken-mouthed ewes. In New Zealand this grass was, until within a few years, confined to the District of Auckland, but it has now spread as far south as Napier and Wellington. Although a tropical grass, it appears to have an extensive range of temperature within which it ripens seed; and it will be interesting to observe, in its further progress southwards, into the colder latitudes of New Zealand, if its ability to ripen seed continues co-extensive with the plant's growth. The moist atmosphere of Auckland has already produced a curious change in this grass, the ripe seed being more firmly attached, so that it is no longer shed freely. Conflicting as this does with the etymology of the generic name *Sporobolus*, which means that the grain is easily shaken out, it is worthy of notice. In the illustration of the floret, Plate XVIII., the grain is shown adhering to the mouth of the floret, being attached by the viscid pericarp, which has become softened by the moist atmosphere at the period of shedding, or, more probably, the adhesion of the seed is the result of continued rains at that time; the spike-like panicles also present a very reddish appearance, due to the exserted dark-orange-coloured seed. This is a hardy grass, and grows freely on dry clay hills where other species would fail; and, from its having deep-seated roots, it defies the driest seasons. It can also be recommended as a fibre material in the manufacture of paper. DISTRIBUTION IN NEW ZEALAND: NORTH ISLAND: AUCKLAND, HAWKE'S BAY, WELLINGTON.

Reference to Plate XVIII.: Fig. 1. Plant. 2. Spikelet, with grain adhering. 3. Floret. 4, 4′. Nervation of empty glumes. 5. Nervation of flowering glume. 6. Nervation of Palea. 7. Scales. 8. Ovary. 9. Grain.

Sporobolus elongatus. *Br.*



## Order GRAMINEÆ.

### Genus XIV.—AGROSTIS, Linnæus.

*Spikelets* small, in an open or contracted panicle, 1-flowered, often pedicelled on long capillary whorled branches. *Empty glumes* 2, nearly equal, acuminate or acute, usually longer than the flowering. *Flowering glume* sessile, or shortly pedicelled, with or without an awn, obtuse, acute, or truncate. *Palea* membranous, nearly as long as the glume; very small or none. *Scales* 2, *Stamens* 2—3. *Grain* terete, free. Distribution of Genus: TEMPERATE AND COLD CLIMATES. *Etymology:* Named from the Greek word for a "field."

Arrangement of the Species:—

I.—*Glumes* membranous, flowering one much shorter than the empty, truncate and jagged at the tip. *Palea* membranous, and much shorter than the flowering glume, or absent, without the pedicel of a second glume at its base.

Flowering glume wholly glabrous, truncate. Panicle usually contracted

Spikelets $\frac{1}{6}$-inch, on hispid pedicels - - - 1. *A. antarctica.*
Spikelets $\frac{1}{12}$—$\frac{1}{10}$-inch; pedicels scarcely scabrid; branches of panicle whorled - - - 2. *A. canina.*
Spikelets $\frac{1}{14}$-inch; pedicels scarcely scabrid - - 3. *A. Muelleri.*
Spikelets $\frac{1}{10}$—$\frac{1}{8}$-inch; pedicels scarcely scabrid - 4. *A. subulata.*
Spikelets $\frac{1}{16}$—$\frac{1}{12}$-inch; pedicels scarcely scabrid; branches of panicle few, opposite or 3-nate. 5. *A. parviflora.*

Flowering glume silky. Panicles very broad.

Leaves narrow, usually involute and filiform - - 6. *A. æmula.*
Leaves broad, flat - - - - - - - 7. *A. pilosa.*

II.—*Glumes* membranous; flowering one much shorter than the empty; usually bearded at the base, and jagged at the tip. *Palea* shorter than the flowering glume, with a silky pedicel of a second

glume at its base. Branches of panicle whorled, capillary. *Spikelets* ⅛—¼-inch long. - - - 8. *A. billardieri.*

III.—*Glumes* hard, coriaceous; flowering nearly as long as the empty, often pedicelled, silky at the base. *Palea* hard, as long as the flowering glume, with a rigid bearded pedicel of a second glume at its base. *Panicle* contracted, branches very short.

Leaves filiform; spikelets $\frac{1}{10}$—⅛-inch; awn exserted 9. *A. setifolia.*
Leaves filiform; spikelets ⅛—¼-inch; awn exserted 10. *A. avenoides*
Leaves concave; spikelets ⅛—¼-inch; awn very short 11. *A, youngii.*
Leaves concave; spikelets ⅛—¼-inch; awn exserted 12. *A. quadriseta.*

Order GRAMINEÆ.

# 1.—AGROSTIS ANTARCTICA.

**CAMPBELL ISLAND BENT GRASS.**

AGROSTIS ANTARCTICA, Hook. fil. Flora Antarct., II., 374. AGROSTIS ANTARCTICA, Hook. fil., Handb. N.Z. Flora, I., 327.

*Culms* erect, tufted, 6—24 inches high, glabrous and smooth. *Leaves* involute, shorter than the culms; sheaths glabrous, smooth; *ligule* oblong, truncate. *Panicle* 1—4 inches long, contracted, nodding, pale green. *Spikelets* crowded on short, erect, hispid pedicels, $\frac{1}{8}$-inch long and upwards. *Empty glumes* nearly equal, lanceolate, long-acuminate; keel ciliate, sides scaberulous; flowering one sessile, half the length of the empty, or shorter, glabrous, membranous, truncate; awn from the middle of the back, rather recurved, longer than the spikelet. *Palea* 0, or small. DISTRIBUTION OF SPECIES; CAMPBELL ISLAND.

There is no specimen of this grass in the Colonial Herbarium, and it cannot therefore be figured. Hooker says of this grass, Fl. Antarct., I., 95: "This is not an uncommon grass at the bases of precipices and on the exposed slopes of the island. It is remarkable for being nearly allied to a species brought by Dr. Jameson from the extreme verge of vegetation on Pichincha, in Columbia, 15,676 feet altitude, for me; that species is, however, more leafy, and its whole culm is enclosed in the sheathing vaginæ."

Order GRAMINEÆ.

## 2.—AGROSTIS CANINA.

### THE BROWN BENT GRASS.

*(Plate XIX.)*

AGROSTIS CANINA, Linnæus. Hook. fil., Fl. N.Z., I., 296; Handb. N.Z. Flora, I., 328. TRICHODIUM CANINUM, Schrœder.

A TUFTED glabrous grass, ascending to 3000 feet altitude. *Flowers* December—February. *Root* perennial, creeping. *Stem* 1—24 inches high, slender. *Leaves* flat or involute, glabrous, short, sheaths smooth; *ligule* oblong, obtuse, entire or lacerate. *Panicle* 2—4 inches long, upright, open when in flower, contracted when in seed; *branches* slender, lower whorled, slightly scabrid. *Spikelets* $\frac{1}{10}$—$\frac{1}{12}$-inch long; pedicels scabrid. *Empty glumes* nearly equal, 3-nerved, lanceolate, acuminate, glabrous; keel ciliate. *Flowering glumes* oblong, truncate, 3-nerved; awn dorsal, or 0. *Palea* 0. *Scale* entire, acute. *Ovary* linear-oblong. *Stamens* 3, short, broad. *Styles* very short. *Stigmas* short, feathery. *Grain* narrow-oblong, obtuse at both ends. DISTRIBUTION OF SPECIES: EUROPE, AMERICA, FALKLAND ISLANDS, FUEGIA, AUSTRALIA, NEW ZEALAND.

**An abundant and wide-spread grass in Europe, and also common in New Zealand; but it has always been regarded in Britain as of little value, either in pasture or agriculture. It is found abundant in boggy situations, where its graceful upright panicle may be seen early in the season; and therefore, although not a first-class grass, it is still very valuable as an early food for stock. Like many other grasses, this species has a wide range of value according to the existing conditions of its growth, being harsh, dry, and unpalatable on dry clay land, whilst on rich moist soil, even with a low temperature, it is more succulent and agreeable to stock. It is variable, to a considerable extent, in size and closeness of panicle, apparently passing in some places into the following species, *Agrostis Muelleri*. It may prove interesting to compare the value of this species with *Agrostis stolonifera*, the Fiorin of agriculturists as regards bulk and amount of nutrient matter, premising that no analysis can ever be constant as regards a species, unless the varieties of the species, as well as the soil and the moisture, be considered. The varieties of Fiorin, according to Sinclair's experiments, "Hortus Gramineus Woburnensis," range in value between 6125 lb. and 16,335 lb.**

bulk per acre; and the nutrient matter contained. from 287 lb. to 930 lb.; therefore, it may reasonably be supposed that the following analysis given of the grass now under notice, *Agrostis canina*, by the same authority, would stand higher as regards both bulk and nutrient matter, if grown under favourable circumstances in the superior climate of New Zealand. The value as grown in England is as follows: 5546 lb. per acre, and the nutrient matter 148 lb.; the weight of nutrient matter when the seed is ripe is superior to that when it is in flower, as 10 to 7. DISTRIBUTION IN NEW ZEALAND: NORTH ISLAND: MOUNTAINOUS PARTS—Colenso. SOUTH ISLAND; NELSON—H. H. Travers; MILFORD SOUND—Lyall; ALPS OF CANTERBURY (2000—4000 feet altitude)—Sinclair, Haast, Armstrong; OTAGO LAKE DISTRICT (3000 feet altitude)—Hector and Buchanan; SOUTHLAND (1000 feet)—Buchanan.

Reference to Plate XIX.: Fig. 1. Plant. 2. Spikelet. 3. Floret. 4. Nervation of empty glumes. 5. Nervation of flowering glume. 6. Scale. 7. Ovary. 8. Grain enclosed in flowering glume.

Agrostis canina, *Linn.*

Order GRAMINEÆ.

## 3.—AGROSTIS MUELLERI.

**ALPINE BENT GRASS.**

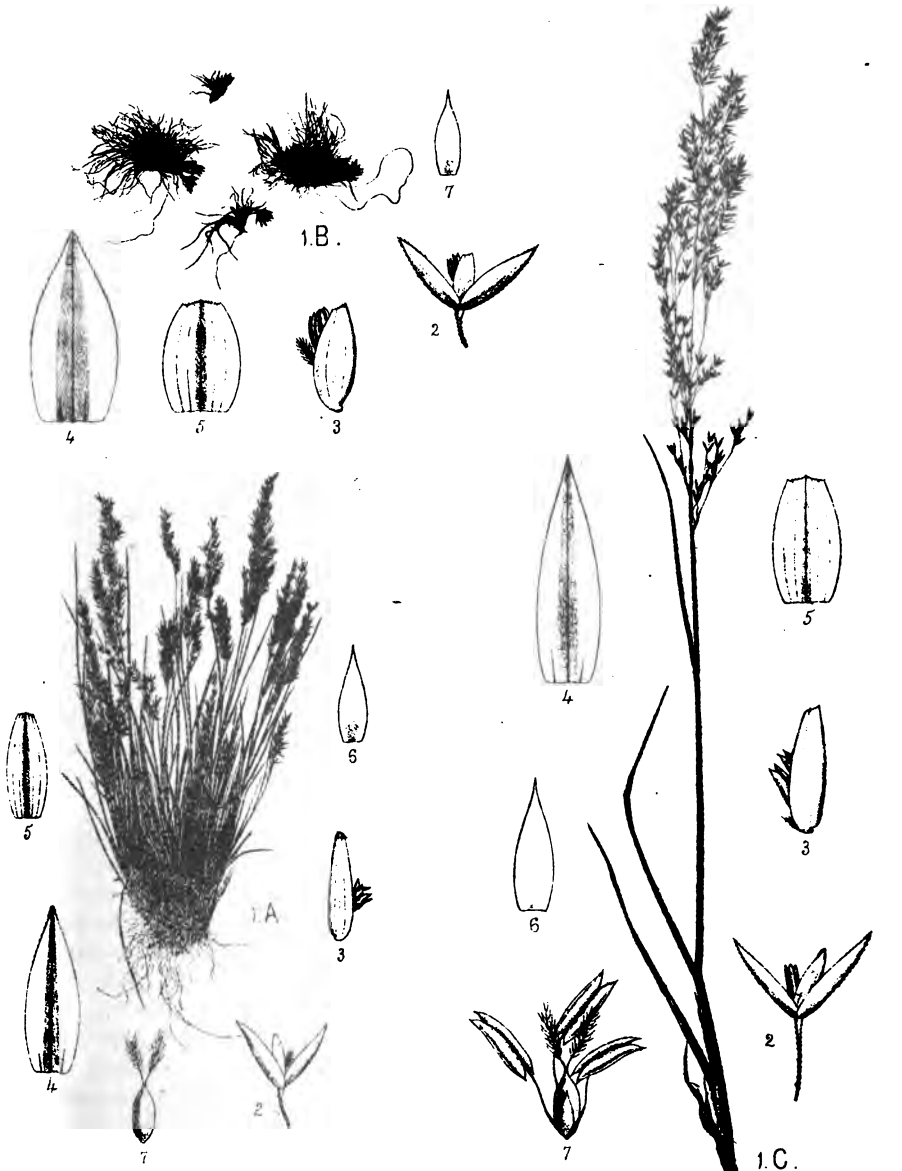
*(Plate XX. A.)*

AGROSTIS GELIDA, F. Muell. Trans. Vict. Inst. 1855, p. 43. AGROSTIS CANINA, Linn. VAR. B. GELIDA. Hook. fil. Handb. N.Z. Flora, I., 328. AGROSTIS MUELLERI, Benth. Flora Australiensis, VII., 576.

A SMALL, tufted, glabrous grass, ascending to 5000 feet altitude. *Flowers* December—March. *Roots* fibrous, creeping. *Stems* 3—5 inches high. *Leaves* shorter than the culms, involute; *ligule* oblong, obtuse, entire or lacerate. *Panicle* ½—1½-inch long. *Empty glumes* nearly equal, oblong-acuminate, scabrid on the margins and keel, 3-nerved, lateral nerves very short. *Flowering glume* oblong, truncate, finely serrate on top, 5-nerved, awnless. *Palea* o. *Scale* entire, oblong, acute. *Stamens* 3, small. *Styles* short; *stigmas* long, feathery.
DISTRIBUTION OF SPECIES: SCOTLAND, AUSTRALIA, NEW ZEALAND.

The present grass which previously formed a variety of *Agrostis canina*, now takes rank as a species, according to Bentham, under the present name. It is a valuable summer sheep grass in mountainous districts, and is probably widely distributed over the upland pastures of New Zealand. It is found abundantly within the winter snow line, and to this circumstance of protection by snow during this season, and a certain amount of rest immediately before and after from grazing, may be attributed the permanency of the species. DISTRIBUTION IN NEW ZEALAND: NORTH ISLAND: RUAHINE MOUNTAINS, 4000—5000 feet—Colenso. SOUTH ISLAND: MOUNT DARWIN—Haast. OTAGO LAKE DISTRICT, 3000—5000 feet—Hector and Buchanan. KAIKOURA MOUNTAIN, 3000—5000 feet—Buchanan.

Reference to Plate XX. A.: Fig. 1. Plant. 2. Spikelet. 3. Floret. 4. Nervation of empty glumes. 5. Nervation of flowering glume. 6. Scale. 7. Ovary.




A. Agrostis canina, *Linn.* Var. *β.-gelida.*
B. " " Var. *γ-subulata.*
C. " parviflora, *Brown.*

Order GRAMINEÆ.

# 4.—AGROSTIS SUBULATA.

### DWARF MOUNTAIN BENT GRASS.

*(Plate XX. B.)*

AGROSTIS SUBULATA, Hook. fil. Fl. Ant., I., 95, t. 53. AGROSTIS PARVIFLORA, R. Brown. VAR. B. PERPUSILLA. Hook. fil. Fl. N.Z. I., 296. AGROSTIS CANINA, Linn. VAR. X. Hook. fil., N.Z. Fl. I., 328.

A MINUTE tufted grass, forming patches on the mountains at an altitude of 5000—7000 feet. *Flowers* January. *Roots* fibrous, creeping. *Stem* ¼—2 inches high. *Leaves* much longer than the culms, involute; *ligule* long, linear, lacerate at top. *Panicle* ⅕—½-inch long, nearly as broad, generally hidden amongst the leaves near the ground. *Spikelets* few, ⅒—¼-inch long, flaccid. *Empty glumes* nearly equal, ovate-acuminate, scabrid on the margins and keel, 3-nerved, lateral nerves very short. *Flowering glume* broadly ovate, truncate, finely serrate on top, 5-nerved, awnless. *Palea* 0. *Scale* entire, oblong, acute. *Stamens* 3, large. *Style* short; *stigmas* long, feathery. DISTRIBUTION OF SPECIES: CAMPBELL'S ISLAND, NEW ZEALAND.

The present species was thus named by Dr. Hooker, in his "Flora Antarctica," from specimens collected by himself in Campbell's Island, it was afterwards described by him as *Var. B.* of *Agrostis canina*, in his New Zealand Flora, and Handbook of the Flora of New Zealand, possessing as it does greater structural difference from *Agrostis canina* than *Var. C. gelida* of the same species, (which variety has recently been raised to the rank of a species under the name of *Agrostis Muelleri*, by Bentham, in Vol. VII., Flora Australiensis,) it has been considered judicious in the present work, to restore Dr. Hooker's original name, *Agrostis subulata*. This species has only been found in three localities in New Zealand, but from its dwarf habit may have often been overlooked. Its close growth and succulent nature indicate it as a good sheep grass, and it might repay the expense of transplanting to lower ground, where it would no doubt increase in size under the influence of a higher temperature. DISTRIBUTION IN NEW ZEALAND: NORTH ISLAND: RUAHINE MOUNTAIN—Colenso; TARA-

RUA MOUNTAIN, 5000 feet—H. H. Travers. SOUTH ISLAND: LAKE TENNYSON, 4400 feet—H. H. Travers.

Reference to Plate XX. B.: Fig. 1. Plant. 2. Spikelet. 3. Floret. 4. Nervation of empty glumes. 5. Nervation of flowering glume. 7. Scale.

Order GRAMINEÆ.

# 5.—AGROSTIS PARVIFLORA.

**SLENDER BENT GRASS.**

*(Plate XX. C.)*

AGROSTIS SCABRA, Willd. Spec., Pl. I., 370. AGROSTIS PARVIFLORA, R. Brown· Hook. fil., Flora Tasmania, II., 113, t. 158B. Fl. N.Z., I., 296 ; Handb. N.Z. Flora, I., 328.

A SLENDER, tufted, glabrous grass, 6—12 inches high, ascending to 3000 feet altitude. *Flowers* January—February. Perennial. *Leaves* narrow, flat or involute, scabrid on the edges; *ligule* oblong, truncate, lacerate. *Panicle* 3—5 inches long, of few short capillary scabrid branches, opposite or 3-nate. *Spikelets* $\frac{1}{12}$—$\frac{1}{10}$-inch long, slender, narrow. *Empty glumes* nearly equal, spreading, glabrous, scabrid on the keel, 1-nerved ; inner glume with two short lateral nerves. *Flowering glume* truncate, 5-nerved ; awn (when present) dorsal, very short. *Palea* 0. *Scales* linear-oblong, tapering to a sharp point. *Ovary* oblong. *Styles* very short. *Stigmas* short, feathery. DISTRIBUTION OF SPECIES: AUSTRALIA, TASMANIA, NEW ZEALAND.

A valuable grass, common on the upland pastures of the South Island, also found at lower levels in both Islands. It is sometimes confounded with *Agrostis canina*, with which it is often associated, and from which it may be best distinguished by its more slender constricted panicle and few narrow spikelets. The abundance of both species may be best observed when they are in flower, which is generally late in the season, when most of the other grasses have ceased growing, thus providing abundance of food when most required. Species of *Agrostis* occupy a prominent place everywhere in the pastures of temperate and cold climates, but their adoption in cultivation has generally been unpopular with agriculturists, from their proving very inconstant in bulk and nutrient value. This defect, to a great extent, is, no doubt, occasioned by the great susceptibility of these grasses to the influence of differences in soil, heat, and moisture. Variation in species from this cause may also be accepted as an important element of difference in value, superior varieties being sometimes produced, of which the well-known Fiorin, *Agrostis alba*, may be cited as an example. A comparison of the slight difference in structural form which may exist between two grasses, while yet differing considerably in value as food, may be made between the species now

under notice—*Agrostis parviflora*, a grass of a delicate succulent habit, and *Agrostis canina*, one more harsh and much less succulent, and of which the first is probably only a variety. The value of the *Agrostis* family in pasture has been very logically argued by Cuthbert W. Johnson, in his "Farmers' Enclyclopœdia," where, under the article "*Agrostis*," he says, "There has been much prejudice existing against the different species of *Agrostis* in general, but let the proprietor of a rich ancient pasture divest a part of it of these grasses entirely, and the value of the plants will be demonstrated in the comparative loss of late and early herbage." DISTRIBUTION IN NEW ZEALAND: NORTH ISLAND: SHORES OF COOK STRAIT —Colenso. SOUTH ISLAND: NELSON—H. H. Travers; CANTERBURY—Armstrong; OTAGO LAKE DISTRICT—Hector and Buchanan; SOUTHLAND—Buchanan.

Reference to Plate XX.: Fig. 1.C. Plant. 2. Spikelet. 3. Floret. 4. Nervation of empty glumes. 5. Nervation of flowering glume. 6. Scale. 7. Ovary, pistil, and stamens.

Order GRAMINEÆ.

# 6.—AGROSTIS ÆMULA.

**TOOTHED BENT GRASS.**

*(Plate XXI.)*

AGROSTIS FORSTERI, Rœmer and Schultes. AGROSTIS LYALLII, Hook. fil. Flora N.Z., I., 297. AGROSTIS LEPTOSTACHYS, Hook. fil. Flora Antarct., I., 94. LACHNAGROSTIS FORSTERI, Trinius. LACHNAGROSTIS ÆMULA, Nees. DEYEUXIA ÆMULA, Kunth. AVENA FILIFORMIS, Forster. DEYEUXIA FORSTERI, Kunth. Hook. fil.; Flora N.Z., I., 298. AGROSTIS ÆMULA, Brown. Hook. fil.; Handb. N.Z. Flora, I., 329.

A VERY delicate glabrous grass, ascending to 2000 feet altitude. *Flowers* November—March. *Root* fibrous. Anuual. *Culms* tufted, 6—24 inches high. *Leaves* very narrow, involute, scaberulous on the edges; *ligule* narrow, oblong, lacerate at top. *Panicle* large, very open, branches capillary, scaberulous, whorled, 3—6 inches long. *Spikelets* $\frac{1}{8}$—$1\frac{1}{6}$-inch long, on very slender, scaberulous pedicels. *Empty glumes* nearly equal, smooth; keel scabrid, 1-nerved. *Flowering glume* shorter, sessile, truncate, with scattered silky hairs, 5-nerved, awn proceeding from the middle of the back. *Palea* (when present) linear-oblong, bifid at top, 2-nerved, and frequently with the silky pedicel of a second glume at base. *Scales* entire, narrow-lanceolate. *Anthers* short, stout. *Styles* very short. *Stigmas* short, feathery. DISTRIBUTION OF SPECIES: AUSTRALIA, TASMANIA, CAMPBELL ISLAND, NEW ZEALAND.

**A widely distributed grass in New Zealand, often forming a prominent part of the pasture on dry, stony, or sandy soils, especially in the North Island. It is valuable as a sheep grass in such places, probably proving perennial when prevented by grazing from ripening its seed, the permanence of such grasses often depending on their capability to stole or form offsets or branches at the roots before flowering and seeding. This grass possesses a large adaptation of growth to varied soils, although most abundant on arid clay land, probably from the absence there of larger grasses; yet, on good soil, when sheltered by shrubs, it attains its greatest height, and is greedily eaten by horses and cattle. On several of the smaller islands of the East Coast of Napier and Auckland, this grass, with its congeners *A. billardieri* and *A. pilosa*, form, when in flower, a prominent feature**

of the open land, attaining under the shelter of *Muhlenbeckia* or *Coprosma* shrubs, a height of 2—3 feet. In such situations it is succulent and nutritious, and closely cropped by stock when present, many of the islands where it abounds being still unstocked with large cattle. DISTRIBUTION IN NEW ZEALAND: FOUND EVERYWHERE FROM SEA-LEVEL TO TWO THOUSAND FEET ALTITUDE.

Reference to Plate XXI.: Fig. 1. Plant. 2, 2′. Spikelet. 3. Nervation of empty glumes. 4. Nervation of flowering glume. 5. Scales. 6. Grain.

Agrostis æmula, *Br.*

# 7.—AGROSTIS PILOSA.

**PILOSE BENT GRASS.**

*(Plate XXII.)*

AGROSTIS PILOSA, A. Richard. Flora. I., 134, t. 23. Hook. fil. Fl. N.Z., I., 297. Handb. N.Z. Flora, I. 329.

A LARGER and more robust grass than the last, *Flowers* November—March. Annual or Perennial. *Culms* tufted, 12—36 inches high. *Leaves* flat, scaberulous on the edges, and sometimes pilose at bottom; *ligule* broad, short and rounded at top. *Panicle* large, 6—18 inches long, 3—10 inches broad, branches whorled, scaberulous. *Spikelets* $\frac{1}{8}$-inch long, on slender scaberulous pedicels. *Empty glumes* nearly equal, margins and keel scabrid, 1-nerved. *Flowering glume* sessile, truncate, with 4 prominent teeth, 5-nerved, pilose, awned near the middle of the back. *Palea* oblong, bifid, 2-nerved. *Scales* entire, narrow-lanceolate, acute. *Stigmas* nearly sessile. DISTRIBUTION OF SPECIES: NEW ZEALAND, CHATHAM ISLANDS.

**This is an abundant and wide spread grass in both Islands, from sea-level to 3000 feet altitude, it differs much from the previous species *A. œmula*, in its larger size and more robust habit, in its more silky or pilose flowering glume, more distinct prolongation of the rachis at back of Palea, terminating in a pencil of silky hairs, and broader pilose leaves. In rich damp ground not subject to summer droughts this grass is perennial, and acquires in such places considerable bulk; it is closely cropped by cattle and sheep, and may be considered a valuable grass both as late and early feed; specimens having been collected in the Botanical Garden, Wellington, in flower, during the late severe winter. DISTRIBUTION IN NEW ZEALAND: NORTH ISLAND: MOUNTAINOUS DISTRICTS OF THE INTERIOR—Colenso. WELLINGTON—Buchanan. SOUTH ISLAND: ASTROLABE HARBOUR, D'URVILLE, NELSON. SUB-ALPINE DISTRICTS: NELSON—H. H. Travers. SOUTHERN ALPS, CANTERBURY—Sinclair, Haast; OTAGO LAKE DISTRICT—Hector and Buchanan; DUNEDIN—Buchanan; CHATHAM ISLANDS—H. H. Travers.**

Reference to Plate XXII.: Fig. 1, Plants. 2. Spikelet. 3. Floret. 4. Nervation of empty glumes. 5. Nervation of flowering glume. 6. Nervation of Palea. 7. Scale. 8. Ovary.

Agrostis pilosa, *A Rich.*

Order GRAMINEÆ.

# 8.—AGROSTIS BILLARDIERI.

**BILLARDIER'S BENT GRASS.**

*(Plate XXIII.)*

AGROSTIS VAGINATA, Steudel. LACHNAGROSTIS BILLARDIERI, Trinius. AVENA FILIFORMIS, Labill. Flora. Nov., Holl. I., 24 t. 31. DEYEUXIA BILLARDIERI, Kunth. Hook. fil., Fl. N.Z., II., 298. AGROSTIS BILLARDIERI, R. Brown. Hook. fil., Fl., Tasm., II., 115. Handb. N.Z. Flora I., 329.

A ROBUST glabrous or scaberulous grass. *Flowers* December—March, Annual or Perennial. *Culms* tufted, 6—18 inches high. *Leaves* 6—10 inches long, broad or narrow, glabrous or pilose; *ligule* short, lacerate on the broad top. *Panicle* 4—8 inches long, open, branches long, whorled, scaberulous. *Spikelets* $\frac{1}{6}$—$\frac{1}{4}$-inch long, on long slender scaberulous pedicels. *Empty glumes* nearly equal, scabrid on the margins and keel, 3-nerved, lateral nerves very short. *Flowering glume* shorter, truncate, with 4 teeth, silky at base, 5-nerved; awn twice as long as the glume, proceeding from the middle of the back. *Palea* with a long silky pedicel at back. *Scales* linear-lanceolate, entire. *Styles* and *Stigmas* equal in length. DISTRIBUTION OF SPECIES: AUSTRALIA, TASMANIA, NEW ZEALAND.

This and the two previous species are closely connected, having many intermediate forms, but in the specific plants so structurally different, as to be easily distinguished. The present species may be characterised as the smallest of the three in size, but largest in the details of the inflorescence. This species may also be considered as of much value in pasture, it is an early grass on the drier districts of the North Island, and has a very extensive range of growth and adaptation to circumstance of soil, moisture, and heat, growing with equal vigour in littoral swamps, on sand hills, and good pasture land; it may also be found in waste places among stones or scrub, being annual on dry clay hills, and perennial on good moist land.

In Vol. VII. of Bentham and Mueller's "Flora Australiensis," recently published, some of the New Zealand *Agrostis* have been removed from that Genus and placed in *Deyeuxia*, from possessing a silky pedicel at the back of the Palea,

as this character is very inconstant with some of the New Zealand species, being very small in some, and frequently absent in *A. æmula*, it has been consi lered inexpedient in the present work, to follow Bentham in this and adding a new Genus to the New Zealand grasses, or otherwise altering the present arrangement found in Hooker's Handb. of the New Zealand Flora, as much confusion might ensue with those who refer to that work as a guide. DISTRIBUTION IN NEW ZEALAND. NORTH ISLAND: BAY OF ISLANDS AND AUCKLAND. EAST COAST—Sinclair, Colenso, Banks, and Solander. ISLANDS OF THE EAST COAST AND WELLINGTON—Buchanan. SOUTH ISLAND: NELSON—H. H. Travers; CANTERBURY—Armstrong; DUNEDIN—Buchanan.

Reference to Plate XXIII.: Fig. 1. Plant. 2. Spikelet. 3. Floret. 4. Nervation of empty glumes. 5. Nervation of flowering glume. 6. Nervation of Palea. 7. Scale. 8. Grain.

Agrostis Billardieri, *Br.*

Order GRAMINEÆ.

# 9.—AGROSTIS SETIFOLIA.

**ALPINE BENT GRASS.**

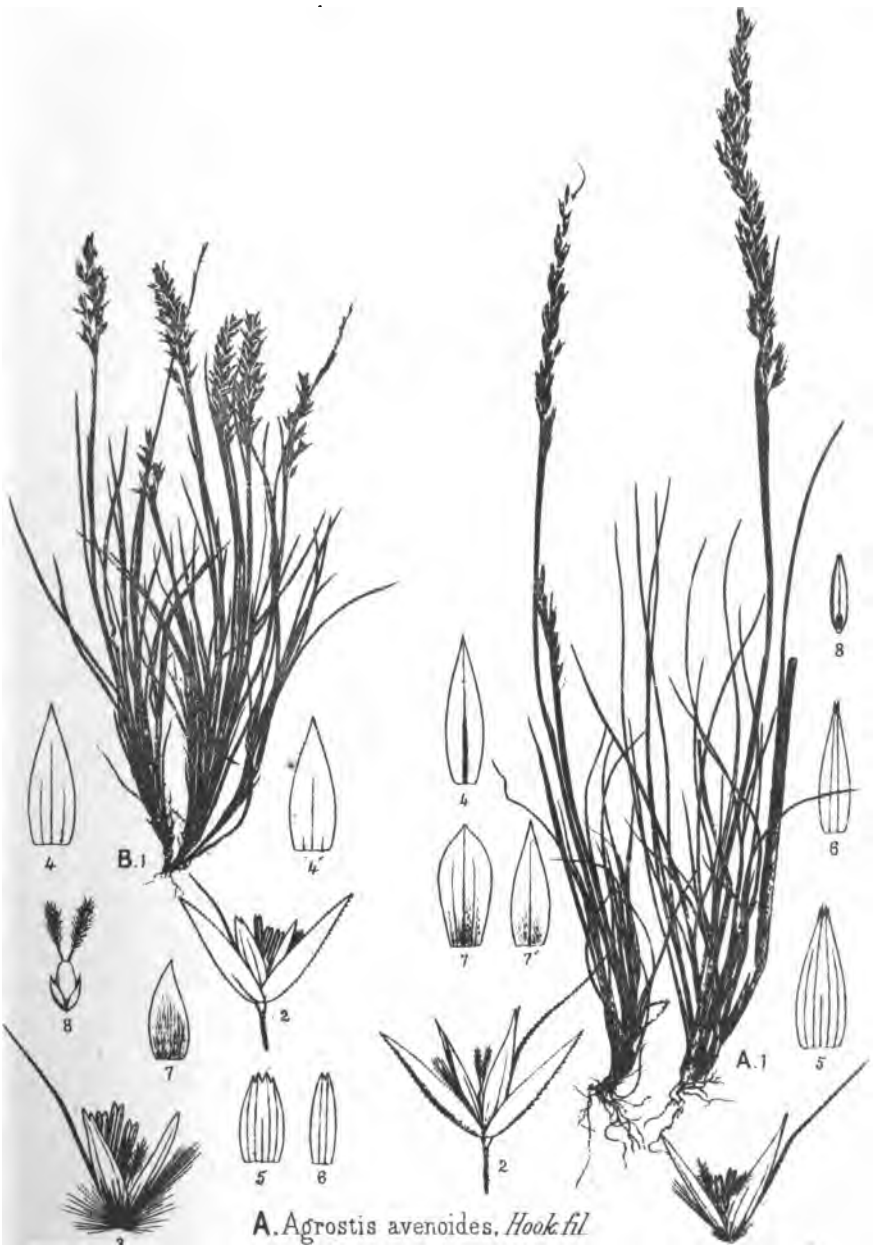
*(Plate XXIV. B.)*

DEYEUXIA SETIFOLIA, Hook. fil., Fl. N.Z., I., 299, t. 65 B.; AGROSTIS SETIFOLIA, Hook. fil., Handb. N.Z. Flora, I., 329.

A SMALL alpine grass. *Flowers*—January. *Roots* perennial. *Culms* tufted, glabrous, grooved, 6—8 inches high. *Leaves* very narrow, involute, shorter than the culms, glabrous; *ligule* oblong. *Panicle* 1—2-inches long, contracted, branches short. *Spikelets* few, $\frac{1}{10}$—$\frac{1}{8}$-inch long, shining. *Empty glumes* unequal, 3-nerved, lateral nerves short. *Flowering glume* sessile, truncate, 4 toothed, $\frac{1}{3}$ shorter than the empty glumes, 5-nerved and with long silky hairs at base; awn nearly twice as long as the glume, proceeding from the middle of the back. *Palea* nearly as long as the glume, bifid, 2-nerved, and with a long silky pedicel at back. *Scales* entire, oblong, acute. *Styles* short. *Stigmas* longer, feathery. DISTRIBUTION OF SPECIES: NEW ZEALAND.

This grass, as far as at present known, appears to be limited in distribution to a few alpine localites in the North Island, it possesses a close habit of growth and succulent nature, and would prove a valuable addition to any pasture. The alpine pastures of New Zealand are unvisited during winter owing to the presence of snow, but are much frequented by sheep in the South Island during summer, when the lower lands are short of feed, and, no doubt, when the alpine portions of the Tararua and Ruahine Mountains, where this species is only found, are opened up for stock by clearing away the bush from their lower slopes, their grazing capabilities will prove equally valuable as that of the South. DISTRIBUTION IN NEW ZEALAND: NORTH ISLAND: RUAHINE MOUNTAIN AND LAKE WAIKARE—Colenso; TARARUA MOUNTAIN—H. H. Travers.

Reference to Plate XXIV. B.: Fig. 1. Plant. 2. Spikelet. 3. Floret. 4, 4'. Nervation of empty glumes. 5. Nervation of flowering glume. 6. Nervation of Palea. 7. Scale. 8. Ovary.




A. Agrostis avenoides, *Hook. fil.*

B. " setifolia, *Hook. fil.*

Order GRAMINEÆ.

# 10.—AGROSTIS AVENOIDES.

**OAT-LIKE BENT GRASS.**

*(Plate XXIV. A.)*

AGROSTIS AVENOIDES, Hook. fil., Handb. N.Z. Flora, I., 330.

A SMALL glabrous grass. *Flowers* January—February. *Roots* perennial. *Culms* rigid, 6—12 inches high, slender. *Leaves* short, numerous, involute, slender; *ligule* short, truncate. *Panicle* much contracted, branches very short, $\frac{1}{8}$—$\frac{1}{4}$-inch long. *Empty glumes* rigid, scabrid on the margins and keel, 3-nerved, lateral nerves (when present) very short. *Flowering glume* sessile, narrow, truncate with 4 teeth, hard, 5-nerved, scabrid on the nerves, silky at the base; awn nearly twice as long as the glume, proceeding from the middle of the back, twisted, recurved. *Palea* nearly as long as the glume, 2-nerved, with a long silky pedicel at back. *Scales* entire, variable, obtuse or acute. *Stigmas* nearly sessile. DISTRIBUTION OF SPECIES: NEW ZEALAND.

An abundant grass in several districts of the South Island, from near sea-level to 3000 feet altitude; it is freely eaten by all kinds of stock, and may be considered as a good pasture grass, the foliage is short and close in growth, and assists in many places in forming a sward amongst the *Danthonia* tussacs. This grass, through injudicious burning by stock-owners, has suffered much during the last twenty years, and is now chiefly found on the banks of creeks and damp places. DISTRIBUTION IN NEW ZEALAND: SOUTH ISLAND: NELSON, SUB-ALPINE DISTRICTS—H. H. Travers; CANTERBURY—Sinclair, Haast, Armstrong; OTAGO LAKE DISTRICT, (3000 feet altitude)—Hector and Buchanan; CLUTHA RIVER AND TRIBUTARIES—Buchanan.

Reference to Plate XXIV. A.: Fig. 1. Plant. 2. Spikelet, 3. Floret. 4. Nervation of empty glumes. 5. Nervation of flowering glume. 6. Nervation of Palea. 7, 7′. Scales. 8. Ovary.

# 11.—AGROSTIS YOUNGII.

YOUNG'S BENT GRASS.

*(Plate XXV.)*

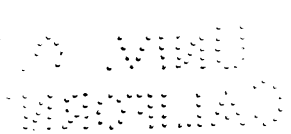
AGROSTIS YOUNGII, Hook. fil., Handb. N.Z. Flora, I., 330.

A TALL robust grass. *Flowers* December—February. *Roots* perennial. *Culms* 1—3 feet high, glabrous or slightly scaberulous. *Leaves* flat, $\frac{1}{6}$—$\frac{1}{4}$-inch broad. *Panicle* 4—6 inches long, erect, much contracted, flexuose, branches very short. *Spikelets* $\frac{1}{6}$—$\frac{1}{4}$-inch long. *Empty glumes* rigid, glabrous, scabrid on the margins and keel, nerveless. *Flowering glume* nearly as long, truncate with 4 teeth, pedicelled, 5-nerved, scabrid on the nerves; awn very short, nearly terminal or proceeding at $\frac{1}{3}$ from the top. *Palea* nearly as long as the glume, bifid, 2-nerved; pedicel short with silky hairs, *Scales* entire, linear-lanceolate. *Ovary* plano-convex. *Styles* very short. *Stigmas* long, feathery. DISTRIBUTION OF SPECIES: NEW ZEALAND.

A common grass in the South Island, varying much in size according to soil and situation, the foliage in the larger states is coarse but succulent, and would form a valuable constituent of mixed fodder. In the district between the Clutha and Mataura Rivers, Otago, this grass is abundant, and is much eaten by stock. In all places where undrained lands and abundant rains are common, all the species of the *Agrostis* family will possess much value as pasture grasses, but however hardy they may be, they enjoy no immunity from overfeeding by either stock or rabbits, and ought to benefit by periods of rest, or the finer kinds will inevitably be killed by sun and frosts. DISTRIBUTION IN NEW ZEALAND: SOUTH ISLAND: NELSON—H. H. Travers; CANTERBURY—Haast; KAIHIKU HILLS, OTAGO—Buchanan.

Reference to Plate XXV.: Fig. 1. Plant. 2. Spikelet. 3. Floret. 4. Nervation of empty glume. 5. Nervation of flowering glume. 6. Nervation of Palea. 7. Scale. 8. Ovary, 2 views.

Agrostis Youngii, *Hook. fil.*



Order GRAMINEÆ.

# 12.—AGROSTIS QUADRISETA.

**SPIKED BENT, OR REED GRASS.**

*(Plates XXVI. A. and B.)*

AGROSTIS ELATIOR, Steud. AVENA QUADRISETA, Labill., Pl. Nov. Holl. I., 25 t. 32. BROMIDIUM QUADRISETUM, Nees. Hook. Lond. Journ., II., 416. AGROSTIS QUADRISETA, R. Brown, Prod. 171. Hook. fil. Fl. Tasm. II., 114. Fl. N.Z. I., 296. Handb. N.Z. Flora, I., 330.

A VERY variable species. *Flowers* December—February. *Roots* perennial, *Culms* 6 inches to 4 feet high, slender or robust. *Leaves* shorter than the culms, flat or involute, often setaceous, glabrous, or scabrid. *Panicle* 2—6 inches long, slender or stout, densely spiked, or interrupted at bottom, lower branches sometimes spreading, whorled. *Spikelets* pedicelled, $\frac{1}{10}$—$\frac{1}{8}$-inch long, shining. *Empty glumes* scabrid on the margins and keel, 1-nerved. *Flowering glume* nearly as long, 5-nerved, on a short bearded pedicel, truncate with 4 teeth; awn short, stout, variable in point of attachment. *Palea* nearly as long as the glume, with a silky pedicel at back, 2-nerved. *Ovary* nearly plano-convex. *Stigmas* sessile, feathery. DISTRIBUTION OF SPECIES: AUSTRALIA, TASMANIA, NEW ZEALAND.

This is a very variable grass both in size and value in pasture, the smaller forms being generally most succulent, especially in sub-alpine districts, the larger again being harsh, and best adapted for cattle. An extraordinary variety of this species is found abundant near Lake Guyon, in the district of Nelson, at an altitude of 2000 feet. (See Plate XXVI. B.) Structurally, this variety differs much from the species, being probably the result of climatic influences. The abnormal condition of the flowers in this variety preventing the possibility of its continuance by seed, would indicate the presence of plants with unaltered flowers in the district to continue it there, although none has been collected. This variety may be described as a very robust, rigid, close spiked grass, having all the parts of the inflorescence abnormally formed, the most prominent feature being the frequent presence of one or two stout rigid pedicels without hairs, at the back of the palea, presenting an instance of a branched prolongation of the rachis beyond the floret. DISTRIBUTION IN NEW ZEALAND: NORTH ISLAND: AUCK-

LAND, BAY OF ISLANDS—Cunningham, Kirk; SOUTH ISLAND: NELSON—H. H. Travers; CANTERBURY—Armstrong; OTAGO—Buchanan.

Reference to Plate XXVI. A.: Fig. 1. Plant. 2. Spikelet. 3. Floret. 4. Nervation of empty glumes. 5. Nervation of flowering glume. 6. Nervation of Palea. 7. Scale. 8. Ovary.

Reference to Plate XXVI. B.: Fig. 1. Plant. 2. Spikelet. 3. Floret. 4, 4′. Nervation of empty glumes. 5. Nervation of flowering glume. 6. Nervation of Palea. 7, 7′, 7′. Scales. 8. Ovary, with scales &c., attached. 8′. Ovary.

Agrostis quadriseta. *Hook. fil.*

Order GRAMINEÆ

GENUS XV.—ARUNDO, Linnæus.

*Spikelets* excessively numerous, 1—5-flowered, in large, nodding, pendulous, or erect panicles. *Empty glumes* nearly equal, very long, lanceolate, acuminate. *Flowering glumes* pedicelled, long, lanceolate, very silky, entire, or with 2 lateral short, or long awns; central awn much longer, straight or twisted. *Palea* short. *Scales* 2. *Stamens* 3. *Grain* free terete. DISTRIBUTION OF GENUS: VARIOUS PARTS OF THE WORLD. *Etymology:* From "Arundo" in Latin, "a reed."

## 1.—ARUNDO CONSPICUA.

**PLUMED TUSSAC GRASS.**

*(Plate XXVII.)*

AGROSTIS AUSTRALIS, A. Rich. AGROSTIS AUSTRALIS, A. Cunn., Prod. AGROSTIS CONSPICUA, A. Cunn., Prod. ACHNATHERUM CONSPICUUM, Palisot. GYNERIUM (?) ZEALANDICUM, Steud. CALAMAGROSTIS CONSPICUA, Gmelin. AGROSTIS PROCERA, A. Rick. ARUNDO CONSPICUA, Forst. Hook. fil. Fl. N.Z. I., 299. ARUNDO CONSPICUA, Forst. Hook. fil. Handb. N.Z. Flora, I., 331.

A LARGE ornamental tussac grass. *Flowers* December—January. *Culms* 6—12 feet high. *Leaves* involute, narrow, often scabrid and cutting; *ligule* 0, or a waved line of short hairs round the mouth of the sheath. *Panicle* 1—2 feet long, shining, white or fulvous, nodding or pendulous. *Spikelets* 1—3-flowered, pedicel capillary. *Empty glumes* ½—1 inch long, 1-nerved, very narrow, tapering, apiculate. *Flowering glume* 3-nerved, with numerous long silky hairs proceeding from near the base, lateral and central awns included within the empty glumes. *Palea* narrow, 2-nerved. *Scales* fleshy, crowned with about 12 long cilia. *Ovary* elongate, narrow. DISTRIBUTION OF SPECIES: NEW ZEALAND.

This grass often forms a conspicuous feature in the scenery of New Zealand, and on low undulating hills or fringing water courses, especially when associated with the Cabbage tree, *Cordyline australis*, presents an unique feature in landscape botany. Several varieties of *Arundo* are found, especially in the North, and on the Islets off the coast, but the whole of these varieties may be arranged under two species—those with nodding or pendulous panicles, having the florets and awns included within the empty glumes, under the present species *Arundo conspicua*: and those with upright panicles having the floret awns not included within the empty glumes, under the next species, *Arundo fulvida*.

The economic value of the New Zealand *Arundo* grasses as fodder plants, has been much overlooked, for if cut down when in flower, they will be found both succulent and agreeable to stock. Experiments made recently on an allied species, (*Arundo sellowiana*, Schultes, better known as *Gynerium argenteum*, Nees, the Pampas grass of South America), by Sir George Grey, at Kawau, and Dr. Curle, at Manawatu, favour the view that these coarse grasses have been neglected, and that they only require to be cut down at the proper time, to insure that stock will eat them greedily. DISTRIBUTION IN NEW ZEALAND: COMMON EVERYWHERE AT LOW ALTITUDES.

Reference to Plate XXVII.: Fig. 1. Branch of a Panicle. 2. Spikelet. 3. Floret. 4. Nervation of empty glumes. 5. Nervation of flowering glumes. 6. Nervation of Palea. 7. Scale. 8. Pistils and stigmas. 9. Grain.

Arundo conspicua., *Forst.*

Order GRAMINEÆ.

## 2.—ARUNDO FULVIDA.

**ERECT PLUMED TUSSAC GRASS.**

*(Plate XXVIII.)*

ARUNDO FULVIDA, Buchanan, Trans. N.Z. Institute, VI., 242. ARUNDO CONSPICUA, Forst. VAR. FULVIDA, Kirk. Trans. N.Z. Institute, X., App. XLIII.

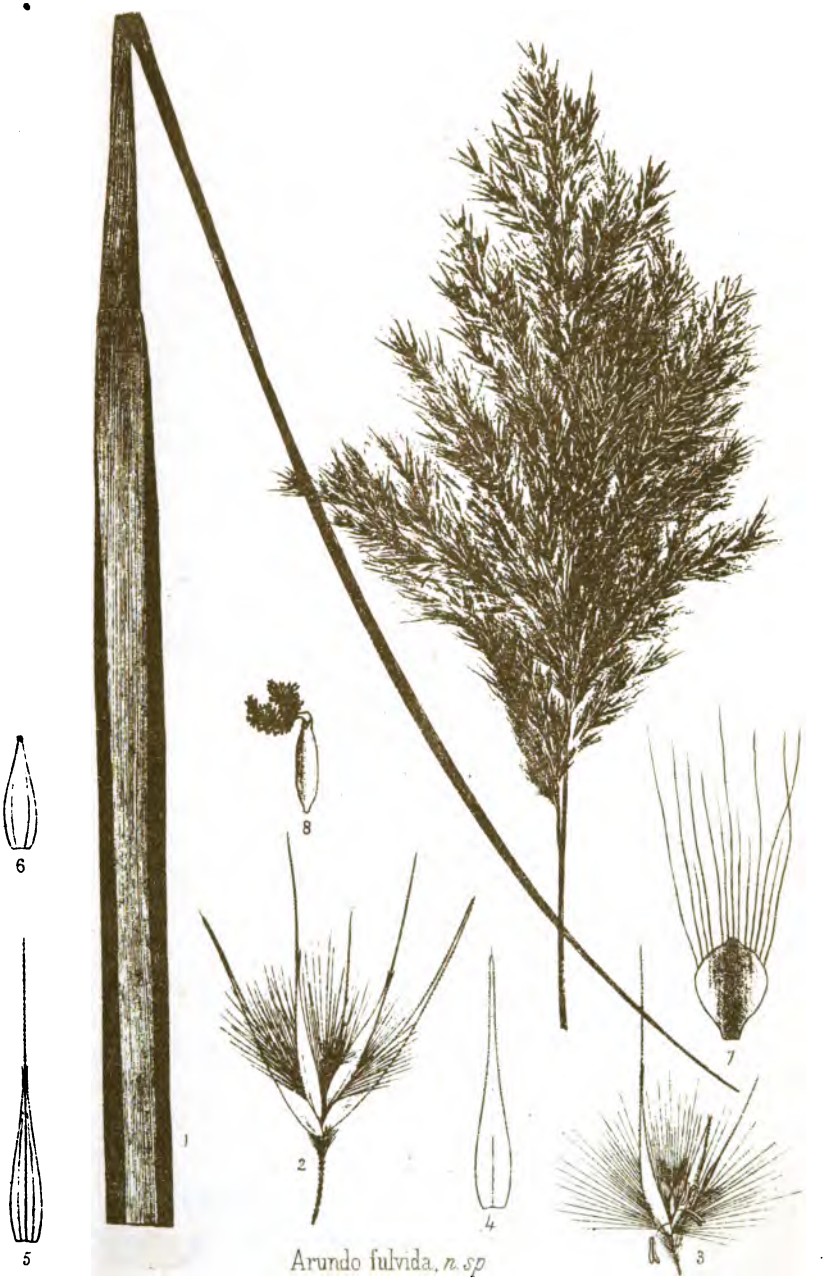
A large ornamental tussac grass. *Flowers* December—January. *Culms* 4—6 feet high. *Leaves* involute, broad, smooth or sparsley covered with silky hairs, and with long attenuate curving points; *ligule* o, or with a waved line of short hairs on mouth of sheath. *Panicle* 12—18 inches long, dense flowered, erect, bright fulvous colour. *Spikelets* 1—2 flowered, pedicels capillary. *Empty glumes* ⅓—½-inch long, 1-nerved, narrow, tapering, apiculate. *Flowering glume* 3-nerved, with numerous long silky hairs proceeding from near the base, lateral awns very short, central awn not included. *Palea* 1-nerved, short, oblong, tapering. *Scales* fleshy, crowned with about 12 cilia. *Ovary* elongate, narrow. DISTRIBUTION OF SPECIES: NEW ZEALAND.

It has been considered expedient in the present work to retain the specific distinction of this grass, in order that the numerous varieties hitherto included under the former species might be arranged into two natural groups. The two species thus adopted will occupy the extreme limits of a large group of varieties, and probably those nearest allied to the present species, may prove the most valuable as fodder plants, from their superior succulence and smoothness. The long straight flower stems, the Kakaho of the Maories, are worthy of attention in husbandry as a first class material for thatching stacks or out-houses. In the primative state of New Zealand colonial society, these grasses known as Toetoe, as also Raupo, *Typha angustifolia*, were much used in roofing buildings both in town and country. The Maoris also produced beautiful specimens of plaiting for the interior decoration of walls from the split stems of the Kakaho, some of which may still be seen near Wellington.

It is highly probable that the cultivation of the *Arundo* grasses under notice, might prove as remunerative as many of the exotic grasses at present recommended. DISTRIBUTION IN NEW ZEALAND: NORTH ISLAND: POVERTY BAY,

SHORES OF WELLINGTON HARBOUR AND COOK STRAIT NEAR WELLINGTON—Buchanan.

Reference to Plate XXVIII.: Fig. 1. Branch of Panicle. 2. Spikelet. 3. Floret. 4. Nervation of empty glumes. 5. Nervation of flowering glume. 6. Nervation of Palea. 7. Scale. 8. Ovary, with stigmas as protruded past the Palea.




Arundo fulvida, *n. sp*

## Order GRAMINEÆ.

### Genus XVI.—DANTHONIA, Decandolle.

Tufted or tussac grasses. *Leaves* flat or involute. *Panicle* effuse or contracted. *Spikelets* pedicelled, the rachis of the spikelet articulating above the outer glumes. *Empty glumes* unequal, keeled, awnless. *Flowering glumes* pedicelled, articulating at the base of each floret, convex at the back, 9-nerved, broadly 2-fid, the divisions cuspidate or awned, dorsal awn from between the divisions, long, slender or stout, filiform or flat and twisted at the base; the awn in some species much reduced, silky, with scattered hairs on the lower half or glabrous, fringed, or with distant tufts of hairs on margin and back, in some cases the hairs are arranged in circles round the glume. *Palea* 2-fid. *Scales* glabrous, fleshy, crowned with long cilia. *Stamens* 3. *Ovary* glabrous. *Grain* free. Distribution of Genus: TEMPERATE REGIONS OF THE NORTHERN HEMISPHERE, SOUTH AFRICA, AUSTRALIA, TASMANIA, NEW ZEALAND. *Etymology:* Named in honour of M. Danthoine, a French Botanist.

Arrangement of the Species:—

I.—*Empty glumes* shorter than the flowering. *Flowering glumes* with scattered silky hairs on the lower half, and fringed on the margins and back with long silky hairs; in *D. Cunninghamii*, often margins only fringed.

Awn subulate, not flattened or twisted.

Panicle open, large, effuse, branches 6—10 inches long - - - - - - - - 1. *D. Cunninghamii.*

Panicle ovate, 3—4 inches long, lax, open; leaves short - - - - - - - - 2. *D. ovata.*

Panicle short, close, ovoid, branches ½—1 inch long - - - - - - - - 3. *D. bromoides.*

Awn flattened and often twisted at the base.

Panicle very lax, open; leaves setaceous - 4. *D. Raoulii.*

Panicle open, 1½-inch long, of 3—5 spikelets; leaves very short, setaceous - - - - 5. *D. australis.*

Panicle very lax, open; leaves flat, coriaceous 6. *D. flavescens.*

II.—*Empty glumes* longer than the flowering, and including them. *Flowering glume* with distant tufts of silky hairs on margins and back; or circles of hair round the glume, fringed with hairs on margins in *D. Buchanani*, and *D. pauciflora*

Awn subulate, not twisted.

Flowering glume with a circle of hairs at bottom, and distant tufts of hairs on margins and back - - - - - - - - 7. *D. pilosa.*

Awn twisted at the base.

Flowering glume with a circle of long hairs beneath the lobes, and a second circle of shorter hairs near the bottom - - - - 8. *D. semi-annularis.*

Flowering glume fringed on the margins only with long silky hairs - - - - - 9. *D. Buchanani.*

Awn very short, lobes not longer than their base.

Flowering glume with one tuft of hairs on each margin - - - - - - - 10. *D. nuda.*

Flowering glume with a fringe of hairs on the lower half of margins - - - - - 11. *D. pauciflora.*

Order GRAMINEÆ.

# 1.—DANTHONIA CUNNINGHAMII.

**SMALL FLOWERED OAT TUSSAC GRASS.**

*(Plate XXIX.)*

DANTHONIA ANTARCTICA, VAR. B. LAXIFOLIA, Hook. fil., Fl. N.Z. I., 303. AGROSTIS PILOSA, A. Cunn., not A. Rich. DANTHONIA RIGIDA, Hook. fil., Fl., N.Z. I., t. 69A., not Raoul. DANTHONIA CUNNINGHAMII, Hook. fil., Handb. N.Z. Flora, I., 332.

A LARGE tussac grass, found from sea-level to 2500 feet altitude. *Flowers* December—January. *Culms* 3—5 feet high, ¼-inch diameter, glabrous or pilose below. *Leaves* 3—4 feet long, coriaceous, concave, ¼-inch broad, glabrous; sheaths broad; *ligule* 0, or a narrow line of short hairs round the mouth of sheath. *Panicle* large, drooping, 10—18 inches long, branches many or few in distant pairs, or single, very slender, 6—12 inches long, pubescent. *Spikelets* alternate on the branches, ¼—½-inch long, 2—8-flowered. *Empty glumes* unequal. 3-nerved. *Flowering glume* deeply 2-fid, 9-nerved, glabrous or sprinkled with hairs on lower half, fringed on margins with long hairs; awn recurved or straight, not flattened or twisted at the base, pedicel tufted with long hairs. *Palea* bifid on top, and with long straggling hairs on the margins. *Scales* linear-oblong, acute, crowned with long cilia. DISTRIBUTION OF SPECIES: NEW ZEALAND.

This grass is widely distributed in New Zealand, but seldom anywhere abundant. It varies much in size in different localities, but although found growing under considerable differences of climate, little change can be observed in its structure, a small flowered form found on the shores of Hick's Bay, Auckland, being nearly identical with specimens from the Mataura Valley, Southland. The subalpine forms of this grass also shew little change, thus affording an argument in favour of the two species *D. Raoulii* and *D. flavescens* being distinct from the present. The twisted awn in the latter species is, however, of very little importance as a specific distinction, being very inconstant, and apparently varying with the amount of moisture in the atmosphere at the time of flowering. From some such cause the broad awns of both *D. Raoulii*, and *D. flavescens*, are frequently straight on

one half of the panicle, and it is sometimes difficult to find a single twisted awn on an entire panicle.

Much that has been said regarding the economic value of the various species of *Arundo* as fodder plants, may also be applied to the large tussac *Danthonias*, but the full value of these large grasses cannot be satisfactorily proved without a certain amount of cultivation. The *Danthonias* possess a superior adaptation to the climate of New Zealand to introduced grasses, as many of the latter when left to their own resources soon disappear, while the smaller species of *Danthonia* are increasing every season, and displacing the introduced grasses. They are certainly more permanent than many of the common exotics, such, for instance, as *Lolium perrene*, which often requires continued sowing to preserve it. In agriculture they also compare favourably with exotics as fodder plants if cut down at the proper time. Horses and cattle eat the succulent panicles of the tussac species when in flower or seed, with apparent relish, and all kinds of stock feed greedily on the young growth after burning. DISTRIBUTION IN NEW ZEALAND: FROM SEA-LEVEL AT HICK'S BAY, AUCKLAND, TO SOUTHLAND—J. Buchanan; STEWART ISLAND—W. Petrie.

Reference to Plate XXIX.: Fig. 1. Branch of a Panicle. 2. Spikelet. 3. Floret. 4, 4'. Nervation of empty glumes. 5. Nervation of flowering glume. 6. Nervation of Palea. 7. Scale. 8. Ovary, styles, and stigmas. 9. Grain.

Danthonia Cunninghamii, *Hook. fil.*

Order GRAMINEÆ.

## 2.—DANTHONIA OVATA, N.S.

*(Plate XXIX. 2.)*

A SMALL sub-alpine tussac grass, found at 4000 feet altitude. *Flowers* January. *Culms* 1½—2 feet high, pilose below. *Leaves* 10—12 inches long, narrow, involute, pilose; *ligule* 0, or with a narrow line of short hairs round the mouth of sheath, and a small tuft of long hairs on each side. *Panicle* 3—4 inches long, erect, ovate; branches alternate, 1—1½ inches long. *Spikelets* alternate on the branches, ½-inch long, 4—6-flowered, 2—4 spikelets on each branch. *Empty glumes* nearly equal, 3-nerved. *Flowering glume* deeply 2-fid with lateral awns, 9-nerved, glabrous, fringed on margins and back with pencils of hairs, central awn straight, not flattened or twisted at the base, pedicel tufted with long hairs. *Palea* bifid on top, and with long straggling hairs on the margins. *Scales* linear-oblong, acute, crowned with long cilia. DISTRIBUTION OF SPECIES: NEW ZEALAND.

This is a grass of apparently limited distribution, and of which little is known, but as the mountainous parts of Southland, where it was discovered, has never been botanically explored, it may probably yet be found abundantly there. The fringed flowering glumes pronounces its affinity to the larger tussac grasses, and the straight subulate awn, more particularly to *D. Cunninghamii*, of which it might be considered as only a variety, but for the much larger spikelets and long lateral awns of the flowering glume, neither has any variation of that species been seen with a similar panicle, or such short leaves. The value of this grass in pasture is not known, but at the time of flowering it is no doubt eaten by sheep who spare nothing at these high altitudes during the summer season. DISTRIBUTION IN NEW ZEALAND: SOUTH ISLAND: MOUNT EGLINTON, SOUTHLAND—J. Morton.

Reference to Plate XXIX. 2.: Fig. 1. Plant. 2. Spikelet. 3. Floret. 4, 4′. Nervation of empty glumes. 5. Nervation of flowering glume. 6. Nervation of Palea. 7. Scale. 8. Ovary, pistils, and stigmas.

Danthonia ovata, *n.s.*

Order GRAMINEÆ.

# 4.—DANTHONIA RAOULII.

### NARROW LEAVED OAT TUSSAC GRASS.

*(Plate XXX.)*

DANTHONIA RIGIDA, Raoul. Hook. fil., Fl. N.Z. I., 303. DANTHONIA RAOULII, Steud. Hook. fil., Handb. N.Z. Flora, I., 332.

A VERY large tussac grass, from sea-level to 4000 feet altitude. *Flowers* December—January. *Culms* 3—8 feet high, ¼-inch diameter. *Leaves* 3—6 feet long, coriaceous, involute and filiform; *ligule* 0, or a line of short hairs round the mouth of sheath. *Panicle* large, drooping, 10—18 inches long; branches 6—12 inches long, distant, often sub-dividing near the bottom. *Spikelets* alternate on the branches, ½—¾-inch long, 4—8 flowered. *Empty glumes* unequal, 3—5-nerved. *Flowering glume* deeply 2-fid, and shortly awned on the lobes, 9-nerved, covered with numerous short hairs on the lower half, margins and back fringed with long hairs, awn flattened and twisted, often straight; pedicel tufted with long hairs. *Palea* bifid at top, with straggling long hairs on the margins. *Scales* oblong-acute, crowned with numerous cilia. DISTRIBUTION OF SPECIES: NEW ZEALAND.

This species forms the largest tussacs of the family, and was very abundant in Otago and Southland before the occupation of the country by settlers. At that time the pasture was very superior, chiefly from the shelter afforded by the numerous large tussacs to the growth of the smaller grasses which were then abundant. Injudicious burning, however, had destroyed all these finer grasses before the enclosure of the land by fencing. On improving land intended exclusively for pastoral purposes, or for the raising of large stock in districts exposed to cold winds, it may be questioned whether the entire destruction of the native grasses, especially the larger tussac kinds, is judicious, as their conservation, or culture, where they do not exist, would certainly prove an element of profit, not only from their own intrinsic value as food, but, also, from their sheltering all kinds of stock, as well as protecting from the nipping winds the smaller grasses which should form the bulk of every pasture. The indigenous grasses of New Zealand are, undoubtedly, more permanent and fattening than the introduced grasses of cultivation, and it might prove expedient in many districts, to adopt a mixed system, by which the larger tussac grasses, both native and introduced, might be planted

out as shelter, along with the main pasture composed of the most permanent species of which seed can be procured, whether exotic or indigenous, as not only would increased profit accrue by the adoption of such a system, but the painful spectacle be avoided of well-bred sheep with no other shelter from the cold than a wire fence. DISTRIBUTION IN NEW ZEALAND. NORTH ISLAND: RUAHINE MOUNTAIN, (3500 feet)—Colenso; TARARUA MOUNTAIN, (4000 feet)—Mitchell. MIDDLE ISLAND. AKAROA—Raoul; ALPS OF CANTERBURY—Sinclair and Haast; MILFORD SOUND—Lyall; OTAGO LAKE DISTRICT, (2000 feet)—Hector and Buchanan.

Reference to Plate XXX.: Fig. 1. Branch of a Panicle. 2. Spikelet. 3. Floret. 4, 4'. Nervation of empty glumes. 5. Nervation of flowering glume. 6. Nervation of Palea. 7. Scale. 8. Grain.

Danthonia Raoulii, *Steud.*

Order GRAMINEÆ.

## 5 —DANTHONIA AUSTRALIS, N.S.

### WIRY LEAVED OAT GRASS.

*(Plate XXXI.)*

DANTHONIA RAOULII, Steud. VAR. A. AUSTRALIS, Buchanan. Trans. N.Z. Inst., IV., 224.

A SMALL rigid grass, growing in dense tussac masses at 6000 feet altitude. *Flowers* January. *Culms* 8—16 inches high. *Leaves* 1—4 inches long, glabrous, erect, very narrow and involute, rigid, setaceous, distichous, secund on the outer culms; *ligule* 0, or a line of short hairs round the mouth of the sheath, and long cilia on each side. *Panicle* 1—1½ inches long, open, 2-branched. *Spikelets* 3—5, with generally 2 spikelets on each branch, and one on the terminal rachis, ½-inch long, 5—7-flowered. *Empty glumes* nearly equal, 5 and 7-nerved. *Flowering glume* deeply 2-fid and shortly awned on the lobes, 9-nerved, glabrous, with silky margins and back fringed with long hairs, awn flattened and twisted, pedicel tufted with long hairs. *Palea* bifid at top, with straggling hairs on the margins. *Scales* ovate-acute, crowned with short cilia. DISTRIBUTION OF SPECIES: NEW ZEALAND.

This grass is found at considerable altitudes in the South Island, and is covered by the snows of winter during several months in the year. It forms a very coarse herbage for sheep, although the early growth in spring may be more grateful and nutritious. The close compacted mass of stems, sheathing leaves and roots, become blanched and succulent, and are much relished by rats, who swarm everywhere on the pastures of the South Island, and are purely vegetable feeders in such localities. DISTRIBUTION IN NEW ZEALAND: SOUTH ISLAND: KAIKOURA MOUNTAINS, (4000—6000 feet)—J. Buchanan; LAKE GUYON DISTRICT, (5000—6000 feet)—H. H. Travers.

Reference to Plate XXXI.: Fig. 1. Plant. 2. Spikelet. 3. Floret. 4, 4'. Nervation of empty glumes. 5. Nervation of flowering glume. 6. Nervation of Palea. 7. Scale. 8. Ovary, styles, and stigmas.

Danthonia australis, R.s.

Order GRAMINEÆ.

# 6.—DANTHONIA FLAVESCENS.

### BROAD LEAVED OAT TUSSAC GRASS

*(Plate XXXII.)*

DANTHONIA FLAVESCENS. Hook. fil., Handb. N.Z. Flora, I., 332.

A LARGE coarse tussac grass, ascending to 3000 feet altitude. *Flowers* January—February. *Culms* 3—5 feet high, ¼-inch diameter. *Leaves* 3—4 feet long, concave or flat, ½-inch or more broad, glabrous. *Sheaths* broad; *ligule* 0, or a line of very short hairs round the mouth of sheath with often a tuft of long hairs on each side. *Panicle* 10—18 inches long, branches few, 6—10 inhes long. *Spikelets* alternate, ¼—¾-inch long, 2—8-flowered, awn flat, and often twisted at bottom. *Empty glumes* nearly equal, 5—7 nerved. *Flowering glume* deeply 2-fid, and shortly awned on the lobes, 9-nerved, covered with numerous short hairs on the lower half, margins and back fringed with long hairs, pedicel tufted with long hairs. *Palea* bifid at top, and with straggling long hairs on margins. *Scale* oblong, acute, and crowned with numerous cilia. DISTRIBUTION OF SPECIES: NEW ZEALAND.

This species is chiefly found at great elevations, and is generally the largest and probably the most ornamental of the group. It is commonly known as the snow grass, although several other tussac grasses, both *Danthonias*, and *Schœnus pauciflorus*, are also known by the same name. This is a valuable grass on the upland sheep runs of the Middle Island, affording both shelter and food for sheep during continued snow storms, and according to Mr. Travers, many sheep are saved every winter through its protection, although frequently covered by snow for weeks, the sheep, even under such adverse circumstances being always found in good condition, the tussacs affording them both shelter and food. By cutting as fodder when the plant is in flower, an abundant supply of winter food could be secured that would serve to keep stock in condition during the hard winter months. It may also be noticed here, that the tussac *Danthonias* can afford an unlimited amount of fibre material for the manufacture of paper, whenever required. DISTRIBUTION IN NEW ZEALAND: MIDDLE ISLAND: ALPS OF CANTERBURY—Sinclair and Haast. OTAGO LAKE DISTRICT, (2000 feet)

—Hector and Buchanan ; ROCK AND PILLAR RANGE TO MAUNGATUA HILL, WEST TAIERI, OTAGO—W. Petrie.

Reference to Plate XXXII. : Fig. 1. Branch of a Panicle. 2. Spikelet. 3. Floret. 4, 4′. Nervation of empty glumes. 5. Nervation of flowering glume. 6. Nervation of Palea. 7. Scale. 8. Ovary and stigmas, as protruded past the Palea.

Danthonia flavescens. *Hook fil.*

Order GRAMINEÆ.

## 7.—DANTHONIA PILOSA.

**PURPLE AWNED OAT GRASS.**

*(Plate XXXIII.)*

DANTHONIA PILOSA, R. Brown. Hook. fil., Fl. Tasm., II., 120; Fl. N.Z., I., 303. DANTHONIA PILOSA, R. Brown. Hook. fil., Fl. N.Z., I., 303. DANTHONIA SEMI-ANNULARIS, R. Brown. Hook. fil. VAR. B. PILOSA, Handb. N.Z. Flora, I., 333. DANTHONIA PILOSA, R. Brown. Benth. Flora Australiensis, VII., 594.

A SLENDER or rigid tufted perennial grass, found from sea-level to 6000 feet altitude. *Flowers* November—January. *Culms* 1—2 feet high, pilose. *Leaves* involute, filiform or flat, pilose; sheathing leaves short; *ligule* 0, or a line of short hairs round mouth of sheath, with a tuft of long hairs on each side. *Panicle* 2—3 inches long, contracted, more open when in flower, with a few erect branches, or simply racemose. *Spikelets* few, ⅓—½-inch long, 4—8-flowered. *Empty glumes* nearly equal, longer than the spikelet, 5—7-nerved. *Flowering glume* glabrous, deeply 2-fid, 9-nerved, with a circle of long hairs near the base, and with distant small pencils of hairs on margins and back, lateral awns as long as the glume, central awn ⅓ longer than the lateral awns, straight, slightly twisted at bottom, awns and tops of florets purple, pedicel with tufts of long hairs. *Palea* truncate, or slightly bifid. *Scales* linear-oblong, acuminate, crowned with long cilia. DISTRIBUTION OF SPECIES: AUSTRALIA, TASMANIA, NEW ZEALAND.

**The present and the following species with their varieties, form an important part of the pastures of New Zealand at the present time, and as they were still more abundant when the land was first stocked, no doubt much of the well-known fattening qualities of the original pasture was indebted to these grasses, Although many grasses are permanently destroyed by overstocking and other causes, the *Danthonias* appear to possess an inherent recuperative power, which enable them at any time when the destroying agency is removed, to renew their growth and spread in abundance. This may be partly ascribed to their capacity of ripening abundance of seed, and their ready adaptation to climatic changes and differences of soil. DISTRIBUTION IN NEW ZEALAND: FROM THE NORTH CAPE TO STEWART ISLAND.**

Reference to Plate XXXIII.: Fig. 1. Plant. 2. Spikelet. 3, Floret. 4, 4'. Nervation of empty glumes. 5. Nervation of flowering glume. 6, Nervation of Palea. 7. Scale. 8. Ovary, styles, and stigmas. 9, 9', 9''. Grain, different views.

## 7.—DANTHONIA PILOSA, VAR. STRICTA.

### HARD OAT GRASS.

*(Plate XXXIII. 2. A.)*

A STRAIGHT rigid grass. *Flowers* November—January. *Culms* 1—2 feet high, rigid, pilose. *Leaves* few, flat or involute, short, pilose, sheathing leaves short. *Panicle* similar to that of the species, but harder. *Florets* glabrous, pencils of hair on back sometimes reduced to one hair, a circle of hairs round the base, awns shorter and less coloured than in the species. DISTRIBUTION IN NEW ZEALAND: SAME AS SPECIES.

Reference to Plate XXXIII. 2. A.: Fig. 1. Plant after flowering. 2. Spikelet. 3. Floret. 4. Nervation of empty glumes. 5. Nervation of flowering glume. 6. Palea. 7. Scale. 8. Ovary, &c.

## 7.—DANTHONIA PILOSA, VAR. RACEMOSA.

### RACEMED OAT GRASS.

*(Plate XXXIII. 2. B.)*

A SLENDER drooping grass. *Flowers* December—January. *Culms* 1—2 feet high, weak, glabrous or pilose. *Leaves* few, very narrow, involute, or flat, glabrous or pilose, sheathing leaves short. *Panicle* racemose, drooping, with few distant spikelets. *Florets* the same as in VAR. STRICTA. DISTRIBUTION IN NEW ZEALAND: SAME RANGE AND HABITATS AS SPECIES.

Reference to Plate XXXIII. 2. B.: Fig. 1. Plant after flowering. 2. Floret. 3. Scales, showing their method of growth from the rachis, the rachis of the next flower articulates at the side as a branch, in *Danthonia*, the scales appear first as 2, membranous, linear-oblong, obtuse, or tapering leaves, which afterwards split up on the upper part into cilia. The stigmas also of several grasses have been observed to be well developed, before separating from a similar membrane.

Danthonia pilosa, *R.Br.*

**A.** Danthonia pilosa, *R.Br.* Var. stricta.

**B.** " " Var. racemósa.

# 8.—DANTHONIA SEMI-ANNULARIS.

**NEW ZEALAND OAT GRASS.**

*(Plate XXXIV.)*

DANTHONIA SEMI-ANNULARIS, R. Brown. Hook. fil., Fl. Tasm., II., 120. ARUNDO SEMI-ANNULARIS, Labill. Pl. Nov. Holl., I., 26 t. 33. DANTHONIA VARIA, Nees, in Pl. Preiss, II., 103. DANTHONIA SETACEA, Hook. fil., Fl. Tasm. II., 121, not of R. Brown. DANTHONIA ERIANTHA, Lindl. in Mitch. Three Exped. II., 307. DANTHONIA GRACILIS, Hook. fil., Fl. N.Z., I., 304, t. 69B. DANTHONIA SEMI-ANNULARIS, R. Brown. Hook. fil., Fl. N.Z. I., 304. DANTHONIA SEMI-ANNULARIS, R. Brown. Hook. fil., Handb. Fl. N.Z. I., 333.

A VALUABLE perennial pasture grass, abundant from sea-level to 6000 feet altitude. *Flowers* November—January. *Culms* 1—2 feet high, glabrous. *Leaves* involute, filiform or flat, glabrous, sheathing leaves long; *ligule* 0, or a line of short hairs round the mouth of sheath, and a tuft of long hairs on each side. *Panicle* 3—5 inches long, contracted, open only when in flower, shortly branched. *Spikelets* few, ⅓—½-inch long, 4—8-flowered. *Empty glumes* white or purplish, nearly equal, 5-nerved. *Flowering glumes* glabrous, deeply 2-fid, 9-nerved, with a circle of long hairs under the lobes, and a second circle of shorter hairs near the bottom, lateral awns ⅓ as long as the glume, central awn 5 times longer than the lateral awns, straight and slightly twisted at bottom, pedicel with tufts of long hairs. *Palea* bifid. *Scale* 3-lobed, and crowned with long cilia. DISTRIBUTION OF SPECIES: AUSTRALIA, TASMANIA, NEW ZEALAND.

This is a valuable pasture grass, proving permanent on dry uplands where introduced species die out, it is also well adapted as a fodder grass, having considerable bulk on good soil. In many districts of the South Island before the introduction of exotic grasses, the natural pasture, of which this grass formed a prominent part, was known by the early settlers to be very fattening to stock, as on occasions when horses or cattle strayed into any remote valleys beyond the settlements, and remained for some time, they always became extremely fat; in the South Island, however, repeated burnings and over-feeding by

sheep and rabbits in some places, have destroyed this wealth of pasture. The varieties of this species are early grasses, supplying nutritious food at a time when most wanted, although the nutrient value will, as with other grasses, prove unequal under the varied conditions of climate and soil found within the extremes of New Zealand latitude. DISTRIBUTION IN NEW ZEALAND: FROM THE NORTH CAPE TO STEWART ISLAND.

Reference to Plate XXXIV.: Fig. 1. Plant. 2. Spikelet. 3. Floret. 4, 4'. Nervation of empty glumes. 5. Nervation of flowering glume. 6. Nervation of Palea. 7. Scale. 8. Ovary, styles, and stigmas. 9. Grain.

## 8.—DANTHONIA SEMI-ANNULARIS. VAR. ALPINA.

### ALPINE OAT GRASS.

*(Plate XXXIV. 2. A.)*

DANTHONIA SEMI-ANNULARIS, R. Brown. VAR. D. ALPINA, Trans. N.Z. Inst., IV., 225.

*Culms* numerous, 10—15 inches high, found at 3500 feet altitude, covering large patches of land. *Flowers* December—January. *Leaves* nearly as long as the culms, very narrow and involute, pilose; *ligule* as in the species. *Panicle* 1½-inches long, contracted, shortly branched. *Spikelets* 12—15, ½-inch long, 5—7-flowered. *Empty glumes* nearly equal, 3-nerved. *Flowering glumes* same as the species, with 2 circles of hairs; pedicels tufted with hairs. DISTRIBUTION OF VAR. ALPINA: SOUTH ISLAND, NEW ZEALAND.

This variety of *D. semi-annularis*, is an abundant grass on the bald-headed mountains near Dusky Bay, forming a close, fine leaved pasture, above the limits of the bush. The mountains being covered by snow during winter, and its weight bearing so long on the grass, it becomes flattened and appressed to the ground, so as to render it very slippery work walking on the slopes. DISTRIBUTION IN NEW ZEALAND: SOUTH ISLAND: DUSKY BAY—Buchanan. NELSON MOUNTAINS—McKay.

Reference to Plate XXXIV. 2. A.: Fig. 1. Plant. 2. Spikelet. 3. Floret. 4. Nervation of empty glume. 5. Nervation of flowering glume. 6. Nervation of Palea. 7. Scale. 8. Ovary, styles, and stigmas.

# 8.—DANTHONIA SEMI-ANNULARIS, VAR. GRACILIS.

**SHEEP OAT GRASS.**

*(Plate XXXIV. 2. B.)*

DANTHONIA GRACILIS, Hook. fil. Fl. N.Z. I., 304 t. 69B. DANTHONIA SEMI-ANNULARIS, R. Brown. Hook. fil. Var. C. GRACILIS, Handb. Fl. N.Z. I., 333.

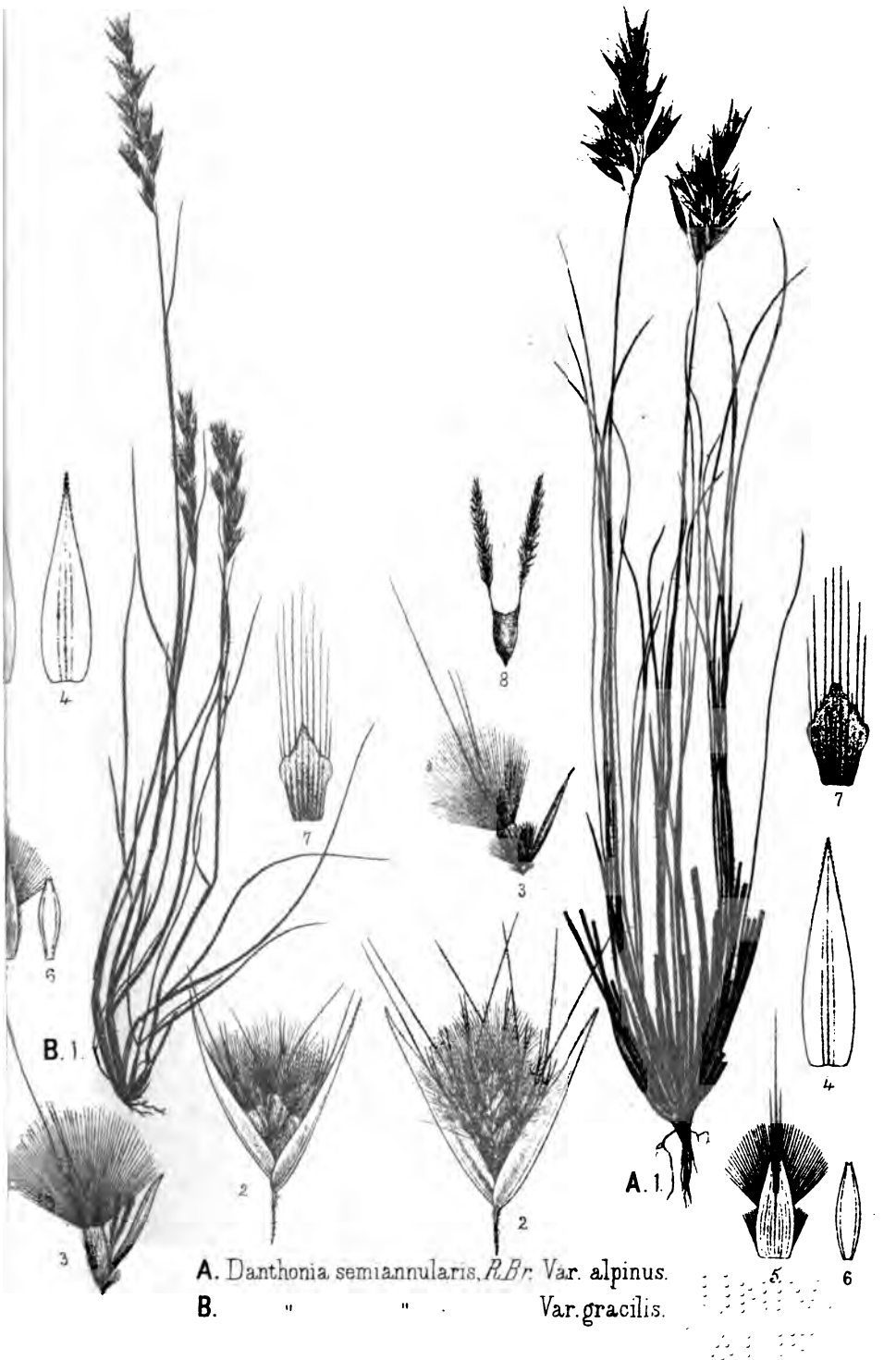
A SLENDER fine-leaved perennial grass. *Flowers* November—January. *Culms* 12—18 inches high. *Leaves* numerous very narrow, involute, glabrous or pilose. *Panicle* 1½—2 inches long, contracted. *Spikelets* ⅓-inch long. *Empty glumes* barred, purple. *Flowering glume* pilose on lower half, with a circle of long hairs under the lobes, lateral awns one-third the length of glume; central awn 4-times longer than lateral awns, straight and twisted slightly at bottom, pedicels with tufts of long hairs. DISTRIBUTION OF VAR. GRACILIS: SAME AS SPECIES.

**This is a valuable sheep grass, often forming a thick close sward; it might also be cultivated as a lawn grass.**

**Reference to Plate XXXIV. 2. B.: Fig. 1. Plant. 2. Spikelet. 3. Floret. 4, 4'. Nervation of empty glumes. 5. Nervation of flowering glume. 6. Nervation of Palea. 7. Scale.**

**NOTE.—No specimen of *D. semi-annularis, Var. B. Unarede*, is in the Museum Herbarium, and therefore cannot be figured.**

Danthonia semiannularis, *R.Br.*




**A.** Danthonia semiannularis, *R.Br.* Var. alpinus.
**B.** " " Var. gracilis.

Order GRAMINEÆ.

# 9.—DANTHONIA BUCHANANI.

**BUCHANAN'S OAT GRASS.**

*(Plate XXXV.)*

DANTHONIA BUCHANANI, Hook. fil. Handb. Fl. N.Z. I., 333.

A TALL, tufted, glabrous, perennial grass, found 1000—2000 feet altitude. *Flowers* January. *Culms* 2—3 feet high. *Leaves* 6—18 inches long, ¼-inch broad, flat or involute, sheathing leaves short; *ligule* very short, truncate, membranous, lacerate on top. *Panicle* contracted, 6—8 inches long, branches few in distant pairs, 1—2 inches long. *Spikelets* few, alternate on the branches and clustered near the ends. *Empty glumes* membranous, ovate-oblong, obtuse, serrate on top, 3-nerved, pale yellow with white margins. Staminiferous *flowering glumes* dark orange, linear-oblong, pilose and fringed on the margins with long hairs, deeply 2-fid, 5-nerved, lobes obtuse, central awn as long as the glume, twisted at bottom and bent near the middle at an obtuse angle. *Palea* of staminiferous florets bifid at top, 2-nerved. Fertile *flowering glume* glabrous, thick and horny, shining, dark orange, ovate, obtuse, entire and ciliate at top, 5-nerved. *Palea* of fertile floret, linear-obtuse, entire, 1-nerved. *Scales* oblong-acute, crowned with short cilia. *Ovary* elongate, narrow. DISTRIBUTION OF SPECIES: SOUTH ISLAND, NEW ZEALAND

NOTE.—The 5-nerved flowering glume of this species is a departure from the constant 9-nerved in *Danthonia*.

Little is known of this grass since it was first discovered near the Wanaka Lake, Otago, by the Geological Survey in 1864. It is a tall oat-like grass, the dark orange spikelets of which attract the attention very readily, and suggest the idea of a cultivated plant; the horses used by the survey party which remained at the main camp for some weeks, fed greedily upon this grass with great relish, and were noticed to prefer it to other grasses. The general appearance of this species is more that of a fodder plant, than one peculiarly adapted for pasture, and it would no doubt repay the expense of an experimental trial, if any of the residents near the locality were to collect the seed. DISTRIBUTION IN NEW ZEALAND: HECTOR'S CAMP, MATUKITUKI VALLEY, NEAR WANAKA LAKE.

Reference to Plate XXXV. : Fig. 1. Plant. 2. Spikelet, 3. Staminiferous floret, (by mistake, stigmas have been drawn in this floret instead of anthers.) 4, 4′. Nervation of empty glumes. 5. Nervation of flowering glume of staminiferous floret. 6. Palea of staminiferous floret. 7. Flowering glume of fertile floret. 8. Palea of fertile floret. 9. Scale. 10. Ovary, styles, and stigmas. 11, 11′. Grain, front and side views.

Danthonia Buchanani. *Hook.fil*

Order GRAMINEÆ.

# 10.—DANTHONIA NUDA.

**NAKED OAT GRASS.**

*(Plate XXXVI. A.)*

DANTHONIA NUDA, Hook. fil., Fl. N.Z. II., 337. DANTHONIA NUDA, Hook. fil., Handb. Fl. N.Z. I., 337.

A SMALL sub-alpine grass, found at 3000—4000 feet altitude. *Flowers* December—January. *Culms* 4—10 inches high, slender. *Leaves* glabrous, shorter than the culms, very narrow, involute, sheathing leaves short; *ligule* 0, or a line of short hairs round mouth of sheath, and long cilia on both sides. *Panicle* ½—2 inches long, of 6—10 erect spikelets, lower spikelets longest branched. *Spikelets* pale purple or greenish white, ½-inch long, 3—5-flowered. *Empty glumes* longer than the spikelets, 5-nerved. *Flowering glumes* glabrous, shortly 2-fid at the top, with a short central awn, 9-nerved, and with one pencil of hairs on each margin; pedicels with short tufts of hairs. *Palea* bifid. *Scales* broad, 3 lobed and crowned with cilia. *Ovary* pear-shaped. *Stigmas* linear. *Grain* narrow-oblong. DISTRIBUTION OF SPECIES: NEW ZEALAND.

**This valuable little pasture grass is abundant on sub-alpine hills, but very apt to be overlooked from its small size, and general resemblance to other grasses, such as small forms of *Poa*, or introduced *Fescues*. From its succulent nature, and as it belongs to the family which includes some of the most nutritious grasses in New Zealand, it may be considered as having some claim as a valuable sheep grass, and also from being indigenous to the soil, it may prove more hardy and better adapted to those bleak hilly districts where it is found, than many of the introduced grasses. DISTRIBUTION IN NEW ZEALAND: NORTH ISLAND: MOUNTAINS NEAR THE EAST COAST—Colenso. SOUTH ISLAND: MOUNTAINS OF NELSON, (4000—5000 feet)—H. H. Travers; KAIHIKU HILLS, OTAGO—J. Buchanan.**

Reference to Plate XXXVI. A: Fig. 1. Plant. 2. Spikelet. 3. Floret. 4. Nervation of empty glumes. 5. Nervation of flowering glume. 6. Nervation of Palea. 7. Scale. 8. Grain.

Order GRAMINEÆ.

# 11.—DANTHONIA PAUCIFLORA.

**FEW FLOWERED OAT GRASS.**

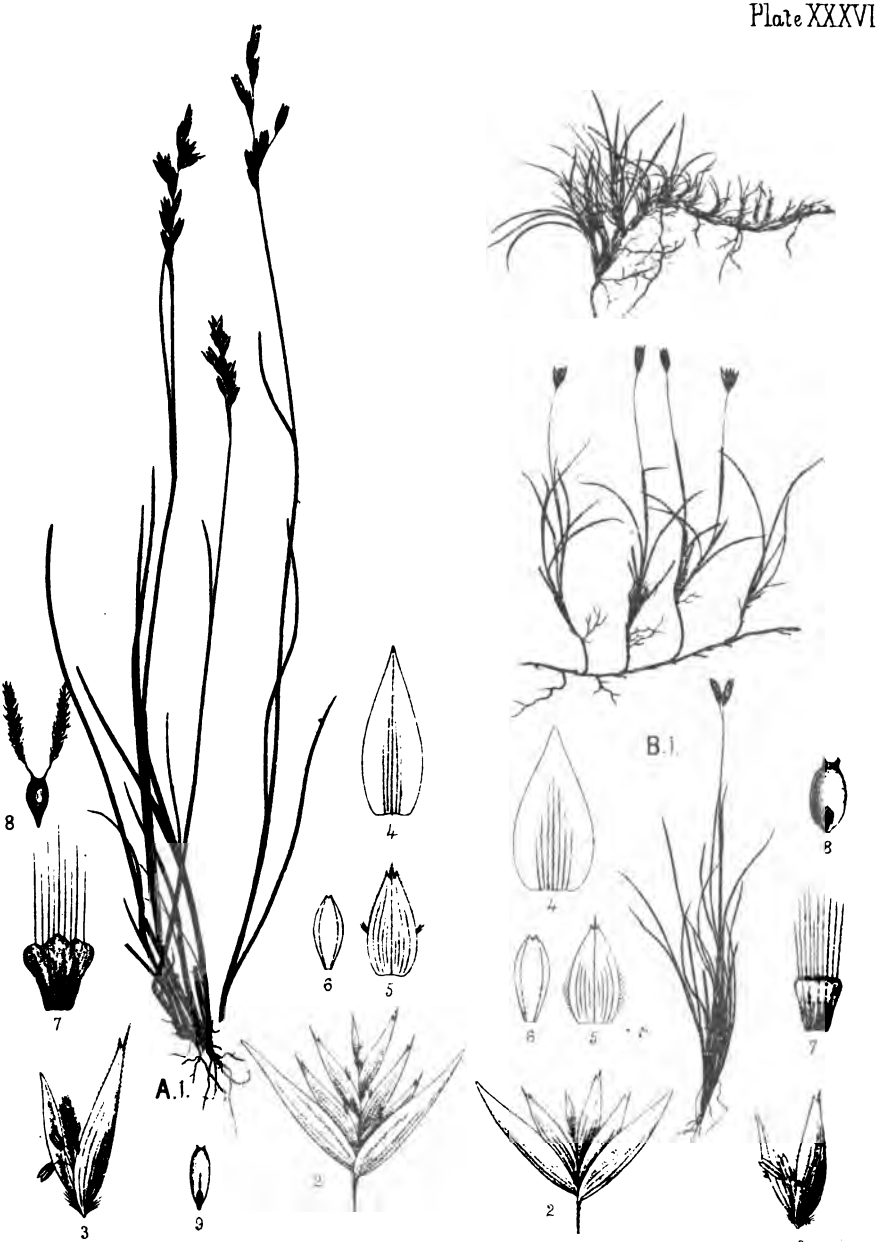
*(Plate XXXVI. B.)*

DANTHONIA PAUCIFLORA, R. Brown. Hook. fil., Fl. Tasm. II., 121 t. 162. DANTHONIA PAUCIFLORA, R. Brown. Benth. Flora Australiensis, VII., 596.

A SMALL alpine pasture grass, found at 2000—5000 feet altitude. *Flowers* December—January. *Branches* prostrate, creeping, forming dense tufts of fine rigid leaves. *Culms* 3—6 inches high. *Leaves* glabrous, 1—3 inches long, rigid, involute, filiform, setaceous; *ligule* 0, or with a few hairs on each side of the sheath. *Panicle* ovoid, of few shortly pedicillate spikelets, sometimes reduced to 1 or 2. *Spikelets* ½-inch long, 2—4-flowered. *Empty glumes* longer than the spikelets, 7-nerved. *Flowering glumes* glabrous, shortly 2-fid at top, with a short central awn, 9-nerved, fringed on the margins with hairs. *Palea* bifid at top, pedicels with short tufts of hairs. *Scales* broadest at top, and crowned with cilia. *Grain* ovate. DISTRIBUTION OF SPECIES: AUSTRALIA, TASMANIA, NEW ZEALAND.

**This very small representative of the Genus was recently detected in a collection from Mt. St. Bathan's, Otago, forwarded by W. Petrie. Its small rigid leaves do not recommend it as a pasture grass, yet from its evident perennial habit, it may prove valuable on those higher altitudes where few grasses can exist. DISTRIBUTION IN NEW ZEALAND: SOUTH ISLAND: MOUNT ST. BATHAN'S, OTAGO, (forming a beautiful sward)—W. Petrie.**

**Reference to Plate XXXVI. B.: Fig. 1. Plant. 2. Spikelet. 3. Floret. 4. Nervation of empty glumes. 5. Nervation of flowering glume. 6. Nervation of Palea. 7. Scales. 8. Grain.**




A. Danthonia nuda., *Hook fil.*

B. " pauciflora *R. Br.*

## Order GRAMINEÆ.

### GENUS XVII.—DESCHAMPSIA, Beauvois.

*Spikelets* 2—3, rarely 1-flowered. *Panicles* large, slender branched, rarely contracted. *Empty glumes* 2, nearly equal. *Flowering glumes* 2—3, and a terminal imperfect one, truncate, 4-toothed, awn dorsal, short, straight, obtuse. *Palea* 2-nerved, 2-fid at the tip. *Scales* 2. *Stamens* 3. *Grain* free. DISTRIBUTION OF GENUS: TEMPERATE REGIONS OF THE NORTHERN AND SOUTHERN HEMISPHERES.

## 1.—DESCHAMPSIA CÆSPITOSA.

**TURFY HAIR GRASS.**

*(Plate XXXVII.)*

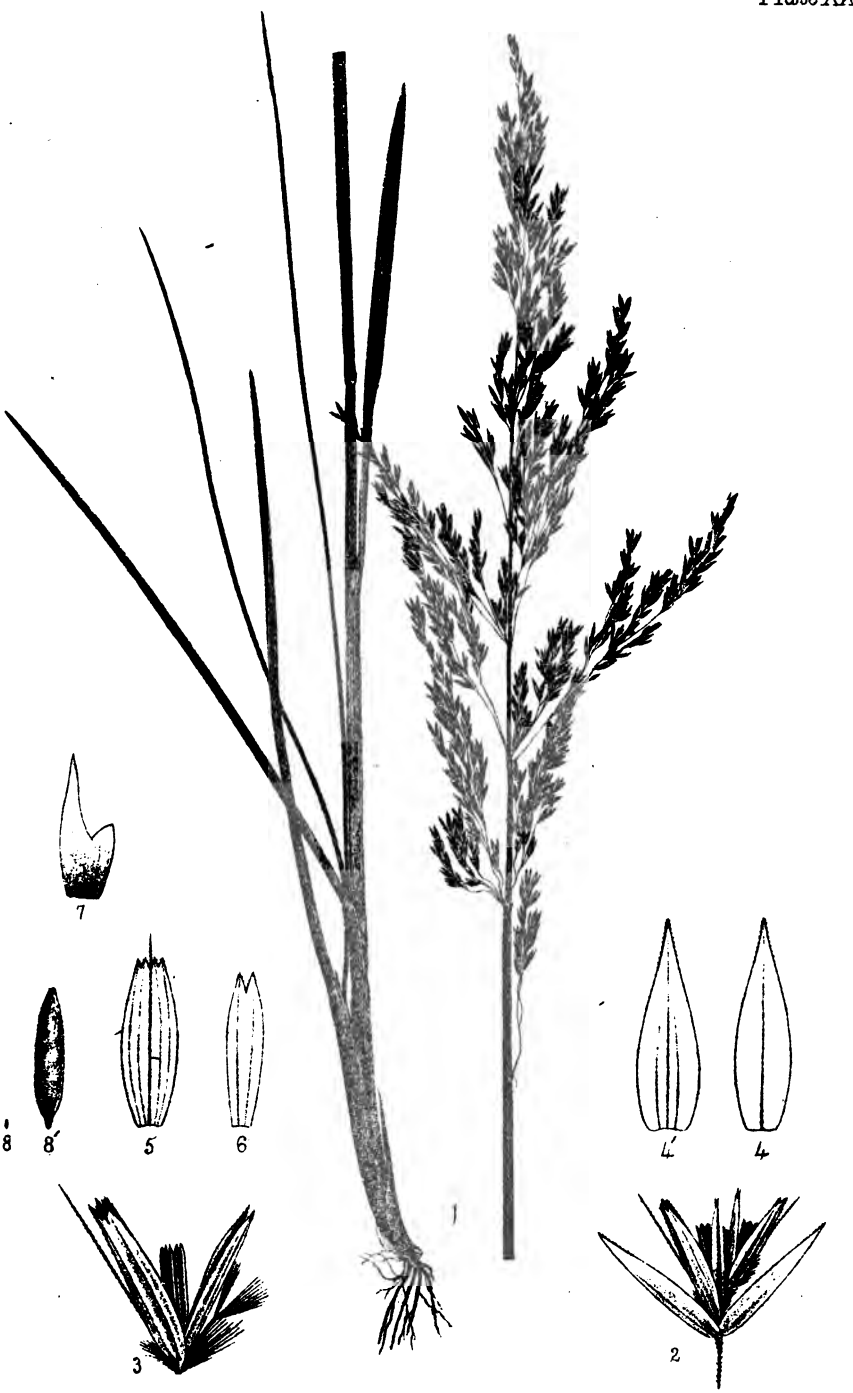
AIRA KINGII, Fl. Antarct., 376 t. 135. TRIODIA SPLENDIDA, Steudel. AIRA AUSTRALIS, Raoul. AGROSTIS AUCKLANDICA, Fl. Antarct. I., 96. DESCHAMPSIA CÆSPITOSA, Beauv. Hook. fil., Fl. N.Z. I., 301. DESCHAMPSIA CÆSPITOSA, Beauv. Hook. fil., Handb. N.Z. Flora, I., 334.

A TALL, glabrous, shining, perennial grass, found from sea-level to 3500 feet altitude. *Flowers* December—February. *Culms* 1—3 feet high. *Leaves* involute, long or short; *ligule* long, acute. *Panicle* open, 3—12 inches long, one sided, branches slender, whorled or fascicled, scaberulous. *Spikelets* $\frac{1}{6}$—$\frac{1}{5}$-inch long. *Empty glumes* nearly equal, linear-oblong, acute, 1—3-nerved. *Flowering glume* truncate and 4-toothed at the top, 5-nerved, awn basal, as long as the glume, pedicel with tufts of long hairs. *Palea* bifid at top, 2-nerved. *Scales* unequally 2-lobed. DISTRIBUTION OF SPECIES: A WIDELY DIFFUSED GRASS IN THE TEMPERATE ZONES OF BOTH THE NORTHERN AND SOUTHERN HEMISPHERES, WITH THE SAME RANGE AS THE GENUS.

**This very graceful showy grass is considered of little value in British agriculture, being deficient in nutriment, and not relished by any kind of stock. Its**

most favourite habitats are wet marshy land, and it can only be tolerated for the shelter it affords to smaller and less hardy species ; it is seldom eaten by stock after the seed is shed, and as regards its nutrient qualities, it will be seen from the Woburn experiments, that, at the time of the seed ripening, it yielded at the rate of 10,209lb. of green produce per acre, which lost in drying, 6891lb., and afforded of nutritive matter, only 319lb. ; its cultivation therefore cannot be recommended, and it will probably disappear wherever the land is drained. Johnson, in his work on British grasses, says, of the tendency of this grass to form tussacs : " In the economy of nature, these tufts, so unsightly and disfiguring to the cultivated landscape, are valuable by contributing to elevate and solidify low lands liable to be overflowed by rivers, aad where they occur on hill and mountain slopes, by binding the spongy soil and preventing the slips which would leave them bare. DISTRIBUTION IN NEW ZEALAND : NORTH AND MIDDLE ISLAND ABUNDANT.

Reference to Plate XXXVII. : Fig. 1. Plant. 2. Spikelet. 3. Floret. 4, 4′. Nervation of empty glumes. 5. Nervation of flowering glume. 6. Nervation of Palea. 7. Scale. 8. Grain, natural size. 8′. Grain enlarged.




Deschampsia cæspitosa, *Palisot.*

Order GRAMINEÆ.

GENUS XVIII.—KŒLERIA, Persoon.

*Spikelets* 2—4-flowered, shortly pedicellate, shining. *Panicle* spike-like, densely cylindrical or interrupted. *Empty glumes* unequal, or nearly equal. *Flowering glumes* bifid at the top, with a short straight, dorsal or nearly intermediate awn, or 0, the lowest glume sessile, the upper on a short articulating rachis. *Palea* 2-nerved, bifid at tip, nearly as long as the glume. *Scales* 2. *Stamens* 3. *Grain* free. DISTRIBUTION OF GENUS: TEMPERATE REGIONS ON THE NORTHERN HEMISPHERE, AUSTRALIA, TASMANIA, NEW ZEALAND. *Etymology:* named in honour of Professor Köeler, an early writer on grasses.

## 1.—KŒLERIA CRISTATA.

**CRESTED HAIR GRASS.**

*(Plate XXXVIII.)*

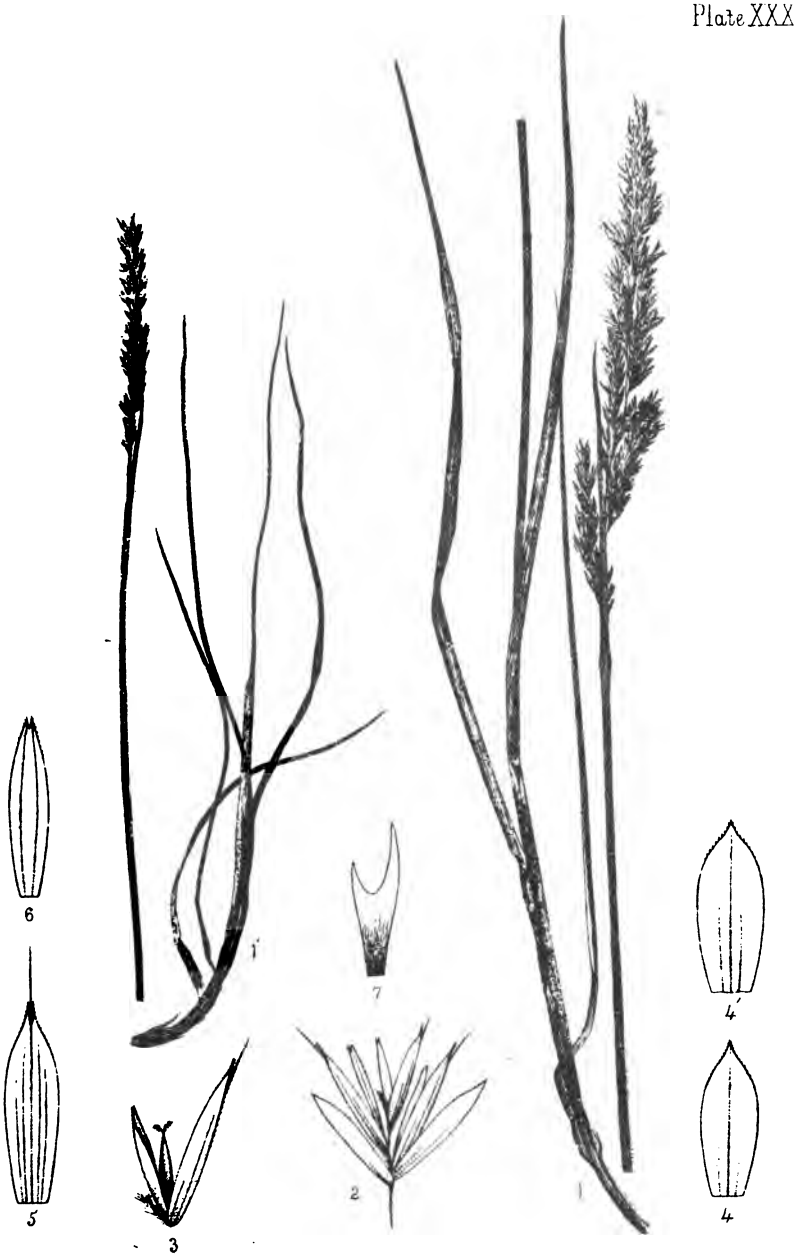
KŒLERIA CRISTATA, Persoon. Hook. fil., Fl. N.Z. I., 305. KŒLERIA CRISTATA, Persoon. Hook. fil., Handb. N.Z. Flora, I., 334.

A SHINING silvery grey grass, found from sea-level to 4000 feet altitude. *Flowers* December—February. *Culms* 1—3 feet high. *Leaves* short, flat or involute, pilose; *ligule* short, rounded at top. *Panicle* erect, 3—5 inches long, narrow, often interrupted or lobed below, branches very short. *Spikelets* crowded, erect, imbricated, white or purplish, 2—3 flowered, $\frac{1}{6}$—$\frac{1}{5}$-inch long. *Empty glumes* unequal, 3-nerved. *Flowering glumes* glabrous, bifid and shortly awned at top, 5-nerved, rachis pilose. *Palea* nearly as long as the glume, bifid at top, 2-nerved. *Scales* unequally 2 lobed. DISTRIBUTION OF SPECIES: MIDDLE ISLAND: AGLIONBY PLAINS—Munro; CANTERBURY PLAINS, AND ACHERON VALLEY (4000 feet)—Travers; OTAGO—Lindsay; OTAGO MOUNTAINS, INLAND—W. Petrie; OTAGO LAKE DISTRICT—Hector and Buchanan; TERRACES

ON THE SOUTHERN ALPS—Sinclair and Haast; CLUTHA VALLEY, (abundant)—Buchanan; NELSON, (3000 feet)—Travers.

This is an abundant grass in the South Island, found chiefly on dry places, it possesses very little nourishment, and therefore cannot be recommended for cultivation; all kinds of stock are said to refuse it, but probably this opinion is based on the experience of rich British pastures, and it may still have some value in places subject to severe drought during exceptionally dry seasons, for however poor the nutrient qualities of certain grasses may be, they enable the stockowner to preserve his stock, till better pasture is more abundant. DISTRIBUTION IN NEW ZEALAND: SOUTH ISLAND: AGLIONBY PLAINS—Munro; CANTERBURY PLAINS AND ACHERON VALLEY, (4000 feet)—Travers, Armstrong; SOUTHERN ALPS—Sinclair and Haast; NELSON MOUNTAINS—H H. Travers; OTAGO LAKE DISTRICT—Hector and Buchanan; OTAGO AND SOUTHLAND, (abundant)—Buchanan.

Reference to Plate XXXVIII.: Fig. 1, 1′. Large and small size of Plant. 2. Spikelet. 3. Floret. 4, 4′. Nervation of empty glumes. 5. Nervation of flowering glume. 6. Nervation of Palea. 7. Scale.




Kœleria cristata. *Persoon*

UNIV. OF CALIFORNIA

## Order GRAMINEÆ

### Genus XIX.—TRISETUM, Kunth.

*Spikelets* 2—3-flowered, rarely 4-flowered. *Panicles* open or contracted *Empty glumes* 2, unequal. *Flowering glumes* 2—3, with a terminal imperfect one, 2-fid at the tip; awn from between the divisions twisted and recurved. *Palea* 2-nerved, 3—4-toothed at top. *Scales* 2. *Grain* free, glabrous. Distribution of Genus: TEMPERATE AND SUB-ALPINE REGIONS OF BOTH NORTHERN AND SOUTHERN HEMISPHERES. *Etymology*: Name "Trisetum," Latin, from the flowering glume being sometimes 3-awned.

Arrangement of the Species:

| | |
|---|---|
| Glabrous, shining, 1—2 feet high. Panicle lax, spreading - - - - - - - - | 1. *T. antarcticum.* |
| Downy, 6—12 inches high. Panicle spiciform | 2. *T. subspicatum.* |
| Pilose, 1—3 feet high. Panicle slender, contracted - - - - - - - - - | 3. *T. Youngii.* |

## 1.—TRISETUM ANTARCTICUM.

**SHINING OAT GRASS.**

*(Plate XXXIX.)*

Aira antarctica, Forst. Avena antarctica, Rœm. and Sch. Avena forsteri, Kunth. Danthonia antarctica, Sprengel. Danthonia pallida, A. Cunn. Trisetum antarcticum, Trinius. Hook. fil., Fl. N.Z. I., 302 t. 68B. Trisetum antarcticum, Trinius. Hook. fil., Handb. N.Z. Flora, I., 335.

A glabrous, shining, perennial grass, found from sea-level to 6000 feet altitude. *Flowers* December—February. *Culms* 1—2 feet high. *Leaves* flat or involute, long or short, often setaceous, pilose, becoming scaberulous after casting the hairs; *ligule* short, truncate, often with long

silky hairs on each side of the sheath. *Panicle* erect, slender, open or contracted, 2—12 inches long, branches short. *Spikelets* $\frac{1}{6}$—$\frac{1}{4}$-inch ong, shining white, or pale green, 3—4-flowered. *Empty glumes* unequal, 3-nerved. *Flowering glumes* deeply 2-fid, 5-nerved, with silky hairs at base; awn recurved, as long as or longer than the glume. *Palea* 4-toothed and lacerate at top, 2-nerved. DISTRIBUTION OF SPECIES: NEW ZEALAND.

This valuable grass is distributed abundantly in both Islands, although it may be said to attain its maximum of growth in the South, where it becomes an important element in the pasture. It varies much in size and amount of contraction in the panicle from the weak delicate form of the Tararua Mountain, Wellington, at 5000 feet altitude, to the large robust form from the Clutha, or Mataura Valleys, but they all possess the same beautiful lustre which attracts notice as an ornamental plant. It is only in the South Island that it attains a size which would entitle it to be considered as a fodder plant, and it might be often judiciously mixed with *Lolium perrene* for this purpose. One strong argument in favour of the cultivation of indigenous grasses, is their great vitality, which may sometimes be observed near homesteads in the South, where enclosed paddocks after having been carefully ploughed and sown with some popular exotic grass, such as *Lolium perrene*, when it will be found that the natural growth of indigenous species, such as the present, has filled the ditches, and covered the waste places along the fences with a better and more permanent crop than that cultivated in the adjoining paddocks, and which it ultimately displaces. DISTRIBUTION IN NEW ZEALAND: NORTH AND SOUTH ISLAND ABUNDANT.

Reference to Plate XXXIX.: Fig. 1, 1′. Plant, shewing open and contracted panicles. 2. Spikelet. 3. Floret. 4, 4′. Nervation of empty glumes. 5. Nervation of flowering glume. 6. Nervation of Palea. 7. Scale. 8. Ovary, styles, and stigmas.

Trisetum antarcticum. *Trinius.*

Order GRAMINEÆ.

## 2.—TRISETUM SUBSPICATUM.

**SPIKED OAT GRASS.**

*(Plate XL. A.)*

TRISETUM SUBSPICATUM, Beauv. Hook. fil., Flora Antarct. I., 97.
TRISETUM SUBSPICATUM, Palisot. Hook. fil., Handb. N.Z. Flora, I., 335.

A SMALL densely tufted alpine grass, found from 500—5000 feet altitude. *Flowers* January. *Culms* 4—18 inches high. *Leaves* flat, as long as, or shorter than the culms, downy; *ligule* short, rounded at top, lacerate. *Panicle* dense, subcylindric, spiciform, 1—4 inches long. *Spikelets* shortly pedicelled, imbricate, $\frac{1}{8}$—$\frac{1}{4}$-inch long, 2—3-flowered, pale greenish white, shining. *Empty glumes* shorter than the spikelet, unequal, very acute or cuspidate, 3-nerved. *Flowering glumes* 2, cuspidate, 5-nerved, awn dorsal, recurved, as long as or longer than the glume, inserted below the 2-cuspidate tip, pedicel tufted with hairs. *Palea* bifid, 2-nerved. DISTRIBUTION OF SPECIES: ARCTIC EUROPE, ASIA, AMERICA, AND ALPS OF THE SAME CONTINENTS; SOUTH AMERICA, FUEGIA, AUSTRALIA, TASMANIA; AUCKLAND, CAMPBELL AND CHATHAM ISLANDS; NEW ZEALAND.

This grass is apparently confined to the South Island, where even it is at present but little known. Hooker says of it in his Antarctic Flora, "Few grasses have so wide a range as this, nor am I acquainted with any other Arctic species which is equally an inhabitant of the opposite polar regions. In Europe it is found at a very great elevation on the Alps and Pyrenees, as also in Lapland. In Asia it frequents the Altai Range, the northern parts of Siberia and Kamschatka, from whence it crosses to Kotzebue's Sound, and is apparently more generally distributed through Arctic America (than in the Old World), from the utmost limits of polar vegetation in Melville Island, throughout Greenland and the Arctic Islands, the Arctic sea-coast, Labrador, Canada, and the Rocky Mountains." It seems improbable that a grass of such vitality and adaptation could be otherwise than valuable, and so, no doubt, it will prove to be when stockowners are enabled to distinguish it from other species. DISTRIBUTION IN NEW ZEALAND: SOUTH ISLAND: LAKE GUYON DISTRICT, NELSON, (5000 feet)—H. H. Travers;

MARLBOROUGH—Kirk; UPPER AWATERE VALLEY, MARLBOROUGH —Sinclair; HOPKINS RIVER, CANTERBURY, (2500 feet)—Haast; OTAGO LAKE DISTRICT, (3000 feet)—Hector and Buchanan; MOUNT ST. BATHAN'S, OTAGO, (5000 feet)—W. Petrie; WESTERN SLOPES OF MOUNT COOK, (5000 feet)—McKay.

Reference to Plate XL. A.: Fig. 1. Plant. 2. Spikelet. 3. Floret. 4, 4′. Nervation of empty glumes. 5. Nervation of flowering glume. 6. Nervation of Palea. 7. Scale.

Order GRAMINEÆ.

## 3.—TRISETUM YOUNGII.

**YOUNG'S OAT GRASS.**

*(Plate XL. B.)*

TRISETUM YOUNGII, Hook. fil., Handb. N.Z. Flora, I., 335.

A TALL perennial alpine grass, found from 3000—5000 feet altitude. *Flowers* January. *Culms* erect, 1—3 feet high, glabrous, shining. *Leaves* flat, $\frac{1}{8}$—$\frac{1}{4}$-inch broad, and sheaths pilose; *ligule* short, rounded at top and lacerate. *Panicle* 3—6 inches long, pale colour, branches very short with few spikelets. *Spikelets* $\frac{1}{3}$—$\frac{1}{2}$-inch long, shining, 1—2-flowered. *Empty glumes* unequal, broad, acute or cuspidate, 3-nerved, as long as or shorter than the spikelet. *Flowering glumes* 2-cuspidate, nearly glabrous; awn dorsal, stout, recurved, inserted below the 2-cuspidate tip, pedicel with silky hairs, *Palea* 4-toothed at tip, 2-nerved. DISTRIBUTION OF SPECIES: NEW ZEALAND.

Owing to the limited distribution of this grass, its true value is little known, but the large size and succulent foliage which it attains, recommend it to notice as a species that will repay the trouble of cultivation. According to Mr. H. H. Travers, who has recently visited the Tararua Mountain, it is there abundant, at an elevation of 5000 feet, and forms large patches of close growth, which, if cut, would produce bulky fodder. It thus appears to be a grass worthy of attention, and would no doubt prove a valuable acquisition to both farmer and grazier at lower altitudes. DISTRIBUTION IN NEW ZEALAND: NORTH ISLAND: TARARUA MOUNTAINS, (5000 feet)—H. H. Travers. SOUTH ISLAND, MACAULAY VALLEY, (3000—4000 feet)—Haast and Young.

Reference to Plate XL. B.: Fig. 1. Plant. 2. Spikelet. 3. Floret. 4, 4'. Nervation of empty glumes. 5. Nervation of flowering glume. 6. Nervation of Palea. 7, 7'. Scales.

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A. Trisetum subspicatum, *Palisot.*

B. " Youngii, *Hook. fil.*

Order GRAMINEÆ.

*Genus, Glyceria; Sub-Order, Festucaceæ.*

GENUS XX.—GLYCERIA, R. Brown.

*Spikelets* few, several flowered, pedicellate in a narrow or contracted panicle. *Empty glumes*, unequal, obtuse or acute, awnless. *Flowering glumes* imbricated, obtuse, awnless. *Palea* nearly as long as the glume. *Scales* 1—2, connate. *Stamens* 2—3. *Grain* glabrous, free. DISTRIBUTION OF GENUS: TEMPERATE REGIONS OF THE NORTHERN AND SOUTHERN HEMISPHERES. *Etymology*: From the Greek word "glyceros," sweet.

## 1.—GLYCERIA STRICTA.

**SWEET GRASS.**

*(Plate, XLI., A.)*

GLYCERIA STRICTA, Hook. fil. Fl. Tasm., II., 123, t. 162B. GLYCERIA STRICTA, Hook. fil. Fl. N.Z., I., 304. GLYCERIA STRICTA, Hook. fil. Benth. Fl. Austral., VII., 658. POA SYRTICA, F. Muell. Trans. Vict. Inst., 1855, 45. FESTUCA SYRTICA, F. Muell. Fragm., VIII., 130. GLYCERIA STRICTA, Hook. fil. Hand. N.Z. Flora, I., 336.

AN erect tufted glabrous grass. *Flowers* December—March. Perennial. *Culms*, 4—24 inches high. *Leaves* shorter than the *culms*, 2—6 inches long, very narrow, involute; *sheaths* large, striate; *ligule* short, broad. *Panicle* 2—6 inches long, *branches* erect, whorled, lower longest, spreading when in flower. *Spikelets* few, 5—10 flowered. *Empty glumes* very unequal, lower 1-nerved, upper 3-nerved. *Flowering glume* obtuse, 5-nerved, none of the nerves reaching the top. *Scales* obliquely ovate, acute. *Grain* linear. DISTRIBUTION OF SPECIES: AUSTRALIA, TASMANIA, NEW ZEALAND.

**This grass is not uncommon on the margins of littoral swamps, or on sand-hills near the sea, and is eaten with much relish by all kinds of stock, the juicy sweetness so characteristic of the genus, proving so strong an attraction for sheep,**

that in many places they prevent it from flowering, so that it is often overlooked by collectors. It is, no doubt, a grass of much value, but is not worth the trouble of cultivation, more especially as a superior introduced species of the same genus, *Glyceria fluitans*, is spreading abundantly in swampy places, and can easily be propagated by inoculation. DISTRIBUTION IN NEW ZEALAND: NORTH ISLAND: HICK'S BAY, AUCKLAND; EVANS' BAY, WELLINGTON—Buchanan; TITIRANGI, AUCKLAND—Cheeseman; AUCKLAND ISTHMUS and WAIHEKI ISLAND—Kirk; EAST COAST—Colenso. SOUTH ISLAND: CANTERBURY—Armstrong; AKAROA, RAOUL, MILFORD SOUND—Enys; DUNEDIN and CLUTHA—Buchanan.

Reference to Plate XLI., A: Fig. 1. Plant. 2. Spikelet. 3. Floret. 4, 4′. Nervation of empty glumes. 5. Nervation of flowering glume. 6. Nervation of Palea. 7. Scale. 8, 8′. Grain, front and side views.

Order GRAMINEÆ.

*Genus, Catabrosa; Sub-Order, Festucaceæ.*

GENUS, XXI.—CATABROSA, Palisot.

*Spikelets* panicled, shining, 2-flowered, lower sessile, upper long pedicelled. *Empty glumes* 2 : unequal, shorter than the flowering. *Flowering glumes* concave, truncate, erose, awned or awnless. *Palea* 2-nerved. *Scales* 2—3. *Stamens* 3. *Grain* glabrous, free. DISTRIBUTION OF GENUS: TEMPERATE CLIMATES OF NORTHERN HEMISPHERE: CAMPBELL ISLAND, NEW ZEALAND. *Etymology:* From the Greek word "Catabrosus," a gnawing, in allusion to the erose tops of the flowering glume, as if bitten or gnawed.

## 1.—CATABROSA ANTARCTICA.

**ALPINE WHORL GRASS.**

*(Plate, XLI., B.)*

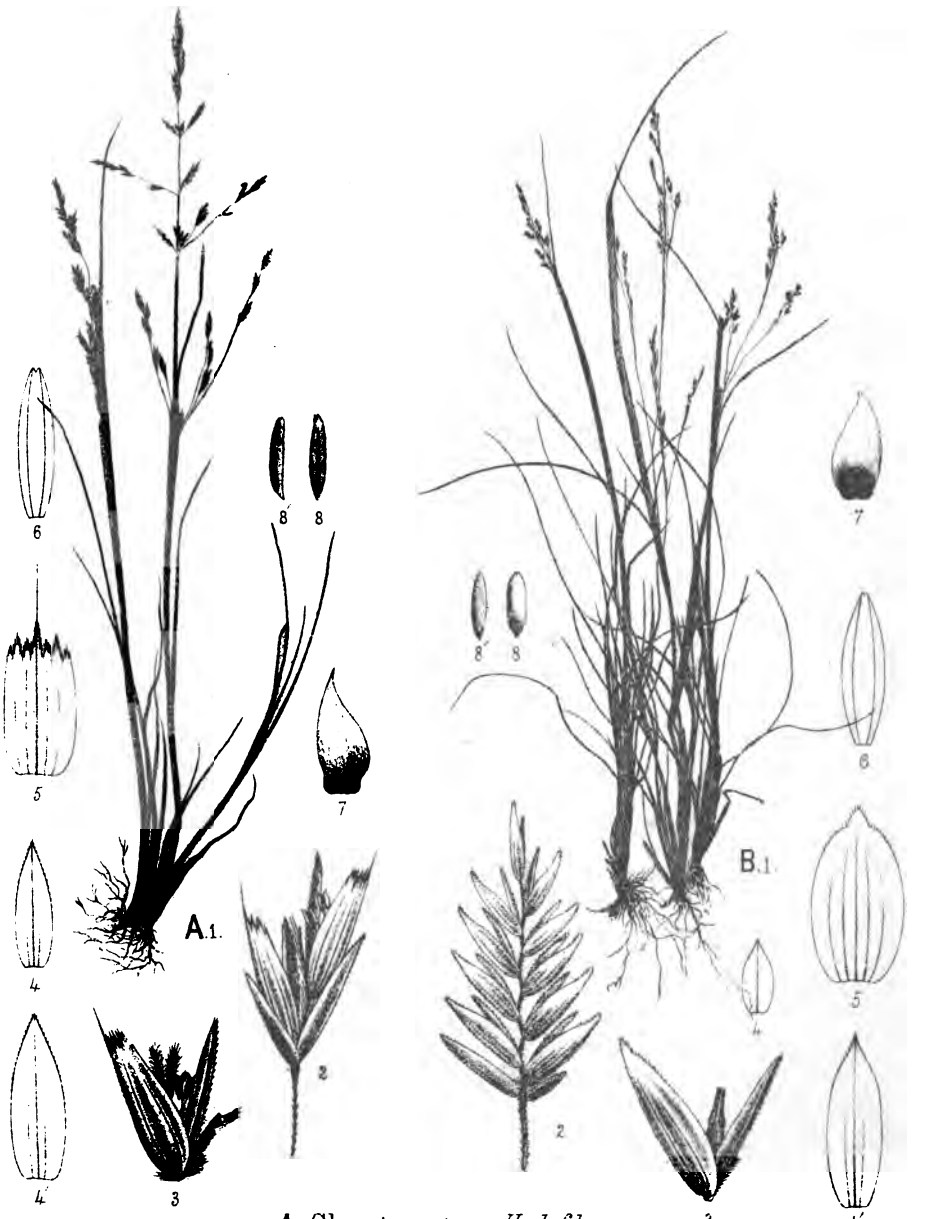
CATABROSA ANTARCTICA, Hook. fil. Flora, Antarct, Part I., 102.
CATABROSA ANTARCTICA, Hook. fil. Flora, N.Z., I., 308, t. 56.
CATABROSA ANTARCTICA, Hook. fil. Handb. Flora, N.Z., I., 336.

A SMALL shining alpine grass, ascending to 5000 feet altitude. *Flowers* January. Perennial. *Culms* 6—12 inches high, numerously branched below, leafy. *Leaves* very narrow, involute, as long as or longer than the culms; *ligule* long, membranous; *sheaths* furrowed. *Panicle* very slender, 3—4 inches long, branches few, whorled. *Spikelets* few, small, flat, pale shining, greenish brown. *Empty glumes* unequal, acute, 3-nerved. *Flowering glume*, erose on the truncate tips, shortly awned, 5-nerved. *Palea* nearly as long as the glume. *Anthers* broad, short. DISTRIBUTION OF SPECIES: CAMPBELL ISLAND, NEW ZEALAND.

This slender little alpine grass forms large patches of a close unmixed pasture, on the Tararua and Ruahine mountains, at an altitude of 5000 feet. It is also, according to Hooker, found in Campbell Island, on moist rocky ledges, at 1000

feet altitude. Nothing is known of its value as a pasture grass, being confined in its distribution to little frequented localities. The representative of this genus in Britain, *Catabrosa aquatica*, is considered valuable, although not a grass of cultivation. It is aquatic in its habits, and much relished by cattle and water fowl, being sweet and succulent. The present species may also prove worthy of attention, being succulent, and having a close habit of growth. DISTRIBUTION IN NEW ZEALAND: NORTH ISLAND: RUAHINE MOUNTAINS—Colenso; TARARUA MOUNTAIN—H. H. Travers. SOUTH ISLAND: MOUNT ARTHUR—Mackay.

Reference to Plate XLI., B: Fig. 1. Plant. 2. Spikelet. 3. Floret. 4, 4′. Nervation of empty glumes. 5. Nervation of flowering glume. 6. Nervation of Palea. 7. Scale. 8, 8′. Grain front and side views.




**A.** Glyceria stricta *Hook fil*

**B.** Catabrosa antarctica, *Hook fil*

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## Order GRAMINEÆ.

*Genus, Poa; Sub-Order; Festucaceæ.*

### GENUS XXII.—POA, Linnæus.

*Spikelets* few or numerous, compressed, 1—10 flowered in a usually open panicle, with the lower branches whorled. *Empty glumes* equal or unequal, acute or acuminate, awnless. *Flowering glumes* obtuse, acute or acuminate, awnless, glabrous, scabrid or silky, naked or webbed at the base, usually 5-nerved, rarely 3 or 7-nerved, often surrounded at base more or less, with long silky hairs, distant on a glabrous or villous rachis, which articulates between the flowering glumes. *Palea* 2-nerved. *Scales* 2, entire. *Stamens* 2 or 3. *Grain* glabrous, free. DISTRIBUTION OF GENUS: IN ALL THE TEMPERATE AND COLD REGIONS OF BOTH HEMISPHERES. *Etymology:* From the Greek word to feed, applied to pasture.

ARRANGEMENT OF THE SPECIES:

Florets with long flocculent silky hairs at base.

*Flowering glumes acute, with incurved tips. Anthers long.*

Panicle open; culms naked below, rigid, branched; leaves flaccid - - - - - - - 1. *P. ramosissima.*

Panicle open; culms leafy from the base; leaves coriaceous, flat - - - - - - 2. *P. foliosoa.*

*Flowering glumes obtuse, straight. Anthers long.*

Culms stout; leaves flat or concave; ligule truncate; spikelets large - - - - - 3. *P. anceps.*

Culms slender; leaves filiform; ligule 0; spikelets small - - - - - - - 4. *P. australis.*

Florets without long flocculent silky hairs at base.

*Flowering glumes acute or acuminate. Anthers long.*

Culms slender; leaves filiform; spikelets large; ligule membranous, sheathing - - - 5. *P. intermedia.*
Culms slender; leaves short, filiform; spikelets small; ligule membranous, sheathing - 6. *P. Colensoi.*
Culms slender; leaves very short, rigid, acicular; ligule membranous, sheathing - - - 7. *P. acicularifolia.*
Culms slender; leaves shorter than the culm, flat; ligule truncate - - - - - - 8. *P. uniflora.*
Culms ½ inch long; leaves very short, rigid, obtuse; ligule acuminate - - - - 9. *P. pygmaea.*

*Flowering glumes obtuse. Anthers short.*

Culms slender, 1—2 inches long; leaves flaccid; short - - - - - - - - - 10. *P. exigua.*
Culms short, stout; leaves rigid, shorter than the culm - - - - - - - - - 11. *P. albida.*
Culms long, stout; leaves flat, shorter than the culm - - - - - - - - - 12. *P. Mackayi.*
Culms slender; leaves flat, shorter than the culm; spikelets tipped with purple - - - 13. *P. Kirkii.*
Culms slender; leaves very short, flaccid; flowering glume with a white membraneous border 14. *P. Lindsayi.*
Culms slender; leaves shorter than the culms; panicle green - - - - - - - 15. *P. breviglumis.*
Culms very slender; leaves much shorter than the culm; whole plant flaccid, green - - 16. *P. imbecille.*

Order GRAMINEÆ.

*Genus, Poa; Sub-Order, Festucaceæ.*

# 1.—POA RAMOSISSIMA.

POA RAMOSISSIMA, Hook. fil. Fl. Antarct. I., 101. POA RAMOSISSIMA, Hook. fil. Handb. Fl. N.Z. I., 338.

*Culms* densely tufted, forming naked, rigid, brown, branching, decumbent stems, 6—10 inches long, from which much divided, flaccid, very leafy, slender branches, 2—6 inches long, ascend. *Leaves* most numerous, very narrow, flaccid, flat $\frac{1}{8}$ inch broad, much longer than the culms; *ligule* oblong, truncate; *sheaths* slender. *Panicle* 1—2 inches long, narrow, green; *branches* quite glabrous, smooth, very short, $\frac{1}{4}$ inch long, interrupted. *Spikelets* $\frac{1}{8}$ inch long, very shortly pedicelled, glabrous, green, 3—5 flowered. *Empty glumes* lanceolate, acuminate, 3-nerved, nearly equal, as long as the flowering, which are narrower, glabrous, acuminate with incurved tips, obscurely 5-nerved, pedicel glabrous or a little webbed. DISTRIBUTION OF SPECIES: AUCKLAND ISLANDS, CAMPBELL ISLAND.

**No specimen of this grass is in the Colonial Herbarium, and it cannot therefore be figured. It has not hitherto been found in New Zealand, but when it is considered, that the large variety of *Poa foliosa*, has only recently been collected on the Traps Rocks, a small group of islets South of New Zealand, it is possible that the present grass may yet be discovered on Stewart Island or adjacent rocks. Quoting from Hooker, Handb. Flora N.Z. I., 338, "It is a grass of remarkable habit, from the long, naked, decumbent bases of the culms, which are excessively branched and leafy above."**

Order GRAMINEÆ.

*Genus, Poa; Sub-Order, Festucaceæ.*

## 2.—POA FOLIOSA, VAR. a.

### AUCKLAND ISLANDS POA.

*(Plate XLII.)*

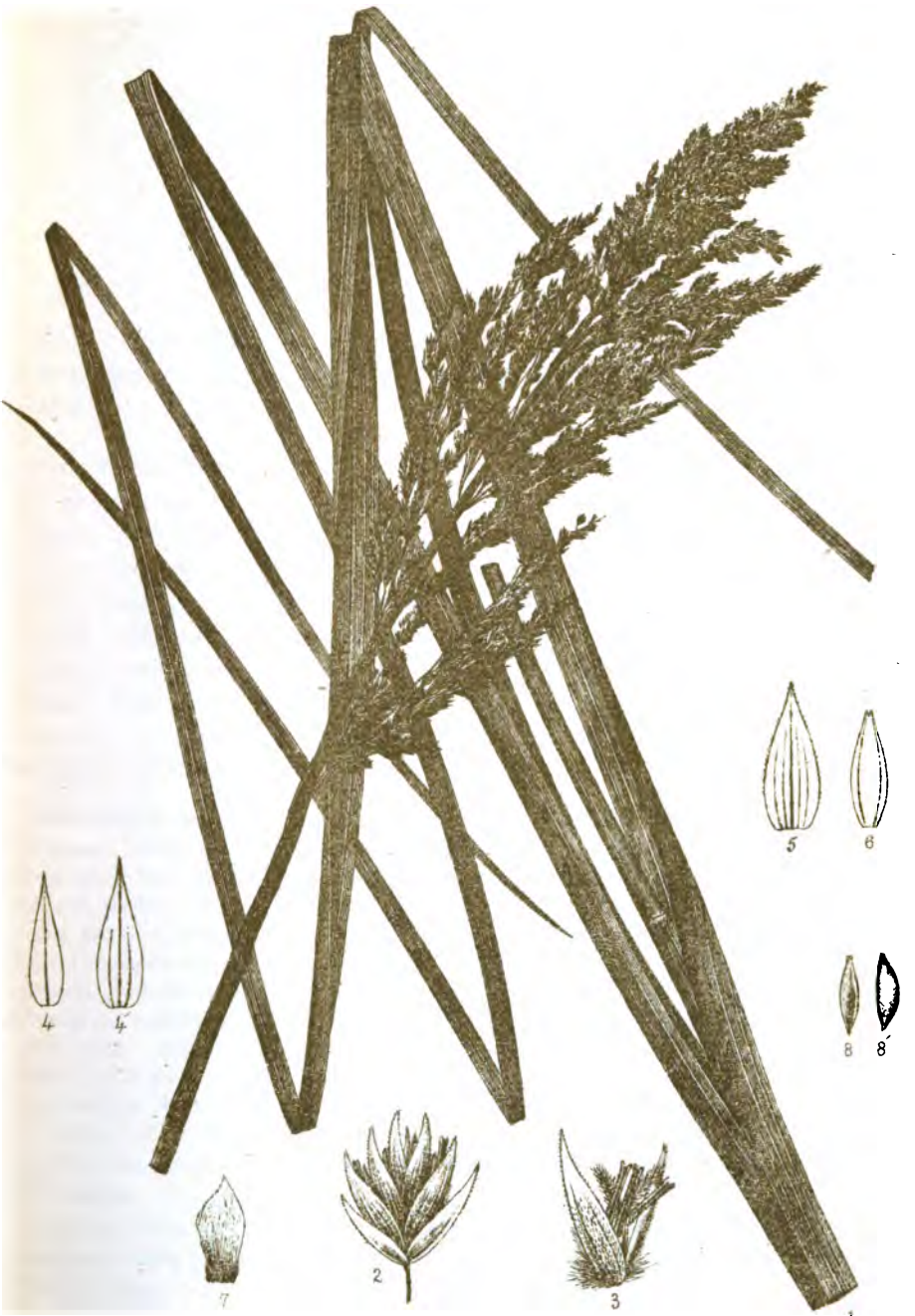
FESTUCA FOLIOSA, Hook. fil. Fl. N.Z. I., 308. FESTUCA FOLIOSA, Hook. fil. Fl. Antarct. I., 99, t. 55. POA FOLIOSA, Hook. fil. Handb. Fl. N.Z. I. 338.

A LARGE, littoral, tussac grass. Perennial. *Culms* 2—3 feet high, glabrous and finely striated. *Leaves* longer than the culms, flat, glabrous and striated, coriaceous, $\frac{1}{4}$—$\frac{3}{4}$ inch broad; sheaths $\frac{3}{4}$—1 inch broad; *ligule* very short. *Panicle* 6—10 inches long, glabrous, branches short, erect or inclined. *Spikelets* numerous, $\frac{1}{4}$—$\frac{1}{3}$ inch long, compressed, 4—8 flowered, shortly pedicelled. *Empty glumes* 1 and 3 nerved. *Flowering glume* scabridus, 5 nerved, middle pair faint, tufts of long, flocculent, silky hairs at base. *Anthers* long. *Scale* oblique, acute. *Grain* stout, linear-oblong. DISTRIBUTION OF VARIETY: AUCKLAND ISLANDS, CAMPBELL ISLAND, NEW ZEALAND.

This variety of *Poa folioso* was added to the New Zealand Flora about four years ago, by Captain Johnson, of the Marine Board, who collected specimens of it on the Traps Rocks, south of Stewart Island, when on a visit there in the Colonial p.s. Luna, on public service. Captain Johnson describes these sea girt rocks, as having a rich damp guana soil, and frequented by numerous sea birds, the surface being chiefly covered with large tussacs of this grass, among which the birds nest. Hooker says of it, Fl. Antarct. I., 99, "It has a large growth and very leafy, affording a rich nutritious food for animals, in some cases it forms large mounds, or tussacs, not unlike the *Dactylis caespitosa* of the Falkland Islands (the tussac grass), but smaller, with, however, a similarly luxuriant habit." Such a valuable grass would no doubt repay the expense of cultivation in New Zealand, and there could be little difficulty in procuring either seed or plants from the Auckland Islands, as they are occasionally visited; it might, however, be more difficult to overcome the prejudice which exists in New Zealand against all large tussac grasses, arising no doubt from an ignorance of their true value, but

no experiments are necessary to establish the value of the two tussac grasses mentioned above, as they are both well known as very fattening food for large stock. DISTRIBUTION IN NEW ZEALAND: TRAPS ROCKS—Johnson.

Reference to Plate XLII: Fig 1. Plant. 2. Spikelet. 3. Floret. 4, 4′. Nervation of empty glumes. 5. Nervation of flowering glume. 6. Nervation of Palea. 7, Scale. 8, 8′. Grain, front and side view.




Poa foliosa *Hook.fil* Var. *a*.

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Order GRAMINEÆ.

*Genus, Poa; Sub-Order, Festucaceæ.*

## 2.—POA FOLIOSA, VAR. b.

**LARGE FLOWERED POA.**

*(Plate XLIII. A.)*

FESTUCA FOLIOSA, Hook. fil. var. B., Fl. Antarct. I., 99. FESTUCA FOLIOSA, Hook. fil. var B., Fl. N.Z. I., 308. POA FOLIOSA, Hook. fil. var. B., Handb. Fl. N.Z. I., 338.

A SMALL tufted, often littoral grass. Perennial. *Culms* 6—12 inches high, glabrous and striated, leafy at the base; *sheaths* $\frac{1}{4}$—$\frac{1}{3}$ inch broad, striated; *ligule* very short. *Leaves* shorter than the *culm*, broad, glabrous. *Panicle* 2—5 inches long, branches short, erect or inclined. *Spikelets* large, $\frac{1}{3}$—$\frac{1}{2}$ inch long, compressed, 4—8 flowered. *Empty glumes* 3 nerved. *Flowering glume* 5 nerved, middle pair faint, and sometimes wanting, scabridus on the nerves, and with tufts of long flocculent hairs at base. *Palea* bifid, 2 nerved. *Anthers* long. *Scale* oblique. DISTRIBUTION OF VARIETY: AUCKLAND ISLANDS, CAMPBELL ISLAND, NEW ZEALAND.

This variety is closely allied to *Poa anceps var. B. foliosa*, but is generally found with a more slender, drooping habit, larger spikelets, and broader leaves, the incurved tips of the flowering glumes, and nervation, being very inconstant. According to Hooker it is an abundant littoral grass in the Auckland and Campbell Islands, and New Zealand. It has also been found at considerable altitudes, being frequently abundant in sub-alpine vegetation, and is also found growing amongst fragments of scoria on Mount Egmont, at an altitude of 7,500 feet. It is an abundant and valuable grass on the mountains of Nelson, Canterbury, and Otago, and is readily eaten by cattle and sheep. DISTRIBUTION IN NEW ZEALAND: NORTH ISLAND: MOUNT EGMONT (6—7,500 feet)—Buchanan. SOUTH ISLAND: MOUNT ARTHUR, (4—200 feet)—Mackay; NELSON MOUNTAINS, (4—500 feet)—H. H. Travers; CANTERBURY ALPS, (4—5000 feet)—Sinclair, Haast, Travers, Armstrong; OTAGO LAKE DISTRICT, (3—5000 feet)—Hector and Buchanan.

Reference to Plate XLIII A. : Fig. 1. Plant. 2. Spikelet. 3. Floret. 4, 4'. Nervation of empty glumes. 5. Nervation of flowering glume. 6. Nervation of Palea. 7. Scale.

Order GRAMINEÆ.

*Genus Poa; Sub-Order, Festucaceæ.*

## 2. POA FOLIOSA, VAR. C.

**MINUTE POA.**

*(Plate, XLIII., B.)*

A VERY minute, tufted, alpine grass. Perennial. *Culms* 1—2 inches high, glabrous. *Leaves* ½—1 inch long, very narrow, involute, obtuse, acicular. *Panicle* ¼—½ inch long. *Spikelets* 2—6 shortly pedicelled, compressed, ⅛ inch long, 2—4 flowered. *Empty glumes*, 3-nerved. *Flowering glume* glabrous, 3-nerved, and with tufts of flocculent silky hairs at base. *Palea bifid*, 2-nerved. *Anthers* long. *Scale* oblique. *Grain* linear. DISTRIBUTION OF SPECIES: NEW ZEALAND.

This small grass appears to be rare, having only been collected in two localities. A large gap exists between this variety and the previous one, var. B., with no apparent intermediate forms, and but for the 3-nerved flowering glume, it might have been placed as a variety of *Poa anceps*, with which species it otherwise agrees in every respect. Its very diminute size might cause it to rank as an inferior pasture grass, but when it is considered how close sheep can graze on poor pastures, it may, where abundant on barren slopes, prove a very relishing nibble to hungry flocks. DISTRIBUTION IN NEW ZEALAND: SOUTH ISLAND: MOUNT EGLINTON, (3000 feet)—J. Morton; MOUNT ARTHUR, (4—200 feet)—A. Mackay.

Reference to plate XLIII. B.: Fig. 1. Plant. 2. Spikelet. 3. Floret. 4, 4'. Nervation of empty glumes. 5. Nervation of flowering glume. 6. Nervation of Palea. 7. Scale. 8, 8'. Grain, front and side views.

A. Poa foliosa. *Hook fil* Var β.
B. " " " Var γ.

UNIV. OF CALIFORNIA

Order GRAMINEÆ.

*Genus, Poa; Sub-Order, Festucaceæ.*

## 3. POA ANCEPS, VAR. a., ELATA.

### NODDING PLUMED POA.

*(Plate, XLIV., A.)*

POA ANCEPS, Forst; Var. A., elata, Hook. fil., Fl. N.Z., I., 306; POA ANCEPS, Forst., Var. A., elata, Hook. fil., Handb. Fl., N.Z., I., 339.

A LARGE tufted, or tussac grass, found at low altitudes. Perennial. *Culm* erect, stout, leafy, 2—3 feet high, glabrous, striated, compressed at the base. *Leaves* longer than the *culm*, distichous, flexuose, flat, smooth and finely striated; *sheaths* narrow, sharply keeled on the back; *ligule* very short. *Panicle* inclined or drooping, 6—12 inches long, ovate, effuse; branches whorled, capillary. *Spikelets* numerous, 1—$\frac{1}{3}$ inch long, flat, 4—6 flowered, green, finely scabridus. *Empty glumes*, 3-nerved. *Flowering glume*, 5-nerved, and with tufts of long flocculent silky hairs at the base. *Palea* 2-fid, 2-nerved. *Scale* acute or obtuse. *Anthers* long. DISTRIBUTION OF VAR. A., ELATA: NEW ZEALAND.

An abundant grass in the North Island, very variable in size. The large drooping panicle and lax leaves much longer than the culm, form its best distinction from the next variety, *B. foliosa*, and its broad leaves and large spikelets from *Poa Australis, var. lævis.* Often assuming the large tussacy habit of the latter species in both islands, and affording in some districts, an abundant supply of a course, though nutritious food for horses and cattle; this is one of the larger grasses of which a considerable part is always refused by stock, through their inability to graze it, but which would be readily eaten, if cut down, and cured as hay, in the flowering season. The present grass may be considered as the type of the genus in New Zealand, being connected by a gradation of varieties with all the other species. The varying form of the scale, as its growth proceeds, is very marked in the genus *Poa.* Thus, in the early stage of growth, it is very short and obtuse, and continues increasing in length and acuteness, till the grain is fully

formed, and it may therefore be found varying on the same panicle. DISTRIBUTION IN NEW ZEALAND: NORTH AND SOUTH ISLAND, common.

Reference to Plate XLIV., A. : Fig. 1. Plant. 2. Spikelet. 3. Floret. 4, 4′. Nervation of empty glumes. 5. Nervation of flowering glumes. 6. Nervation of Palea. 7. Scale. 8, 8′. Grain, front and side view.

Order GRAMINIEÆ.

*Genus, Poa; Sub-Order, Festucaceæ.*

## 3.—POA ANCEPS, VAR. b., FOLIOSA.

**COMMON FIELD POA.**

*(Plate XLIV., B.)*

POA ANCEPS, Forst. var. b., foliosa, Hook. fil., Fl. N.Z., I., 306. POA ANCEPS, Forst. var. b., foliosa, Hook. fil., Handb. Fl. N.Z., I., 339.

A SMALLER tufted grass than the last, with sometimes prostrate branching stems. Perennial. Found from sea level to 5000 feet altitude. *Culms* erect, 1—2 feet high. *Leaves* distichous, strict, shorter than the culm, $\frac{1}{10}$—$\frac{1}{4}$ inch broad. *Panicle* contracted, 2—8 inches long, erect, branches in distant pairs, short, capillary. *Spikelets* few, $\frac{1}{4}$ inch long, flat, 3—4 flowered, finely scabridus, green. *Empty glumes* 3-nerved. *Flowering glume* 5-nerved, and tufted at the base, with long flocculent silky hairs. *Palea* 2-fid, 2-nerved. *Scale* narrow, acute. *Anthers* long. *Grain* narrow. DISTRIBUTION OF VAR. b.: NEW ZEALAND.

This is perhaps the most abundant and wide-spread grass in New Zealand, and in all the varying circumstances under which it is found, retaining its distinguishing characters. It possesses a great power of adaptation to varieties of soil and climate, being often found struggling under the most adverse circumstances of poverty, on dry barren ground. From a recent collection of grasses made by Mr. A. Mackay on Mount Arthur, it appears that the maximum growth of certain grasses, among which the present is prominent, is at altitudes of 3—4000 feet, where a temperate climate and abundant moisture prevails during summer. Under such favourable circumstances, the tufted habit disappears, and a close heavy growth 18—24 inches high is found, which might easily be mistaken for a cultivated crop. The pasture of these upland table lands which are covered by snow during six months of the year, is for variety of species, and bulk of growth, unequalled at lower levels. This grass may be placed as one of the most valuable in New Zealand, for although a few others may prove more nutritious, it resists better the exterminating effects of both drought and fire, thus ensuing a certain

amount of permanent pasture. DISTRIBUTION IN NEW ZEALAND: FOUND EVERYWHERE BETWEEN SEA LEVEL, AND 5000 FEET ALTITUDE.

Reference to Plate XLIV., B. : Fig. 1. Plant. 2. Spikelet. 3. Floret. 4, 4′. Nervation of empty glumes. 5. Nervation of flowering glume. 6. Nervation of Palea. 7. Scale. 8, 8′. Grain, front and side view.

A. Poa anceps, *Forst* Var *a. elata.*
B. " " Var *B. foliosa.*

UNIV.

Order GRAMINEÆ.

*Genus, Poa; Sub-Order, Festucaceæ.*

## 3.—POA ANCEPS, VAR. C., BREVICULMIS.

### HARD SHORT STEMMED POA.

*(Plate, XLV., C.)*

POA ANCEPS, Forst. var. c., breviculmis, Hook. fil., N.Z. Fl., I., 306. POA ANCEPS, Forst. var. c., breviculmis, Hook. fil., Handb. N.Z., I., 339.

A SMALL prostrate branching grass, branches ascending, found from sea level to 3000 feet altitude. Perennial. *Culms* 4—6 inches high, prostrate at the base. *Leaves* 2—4 inches long, curving, distichous, smooth. *Panicle* 1—1½ inches long, ovate, contracted, smooth. *Spikelets* small, short, broad, 2—4 flowered. *Empty glumes* 3-nerved. *Flowering glume* 5-nerved, scabridus, and with long tufts of long flocculent silky hair at base. *Palea* bifid, 2-nerved. *Scales* oblique, acute. *Anthers* long. DISTRIBUTION OF VAR. C., BREVICULMIS: NEW ZEALAND.

This variety of *Poa anceps* is most prevalent on poor dry soil, being often abundant on dry gravel terraces, when under such circumstances, it is of a harsh nature, and refused by stock when more succulent grasses are present. This harshness of foliage, however, in many grasses, is not a proof of the absence of nutrient properties, as many such are fattening, and if cut down are readily eaten. The selection of pasture best adapted for aged sheep is of much importance, as they would be certain to fall off in condition where grasses, such as the present species are abundant, from sheer inability to graze them. DISTRIBUTION IN NEW ZEALAND: NOT UNCOMMON IN THE DRY UPLAND PASTURES OF THE SOUTH ISLAND.

Reference to Plate XLV., C.: Fig. 1. Plant. 2. Spikelet. 3. Floret. 4, 4′. Nervation of empty glumes. 5. Nervation of flowering glume. 6. Nervation of Palea. 7. Scale. 8, 8′. Grain, front and side views.

Order GRAMINEÆ.

*Genus, Poa; Sub-Order, Festucaceæ.*

## 3.—POA ANCEPS, VAR. d., DENSIFLORA.

**DENSE FLOWERED POA.**

*(Plate XLV., D.)*

POA ANCEPS, Forst. var. d., densiflora, Hook. fil. Handb. Fl. N.Z., I., 339.

A SMALL erect, rigid,tufted, sub-alpine grass, found at 3—4000 feet altitude. Perennial. *Culms* 10—20 inches high. *Leaves* 6—10 inches long, concave, rigid, acicular, glabrous. *Panicle* 2—4 inches long, ovate, dense. *Spikelets* ½ inch long, 4—5 flowered. *Empty glumes* 3-nerved. *Flowering glumes* 5-nerved, scabridus, and with long tufts of flocculent silky hair at the base. *Palea* 2-fid, 2-nerved. *Scales* oblique. *Anthers* long. DISTRIBUTION OF VAR. d, DENSIFLORA: NEW ZEALAND, SOUTH ISLAND.

**This is apparently only a larger form of the last variety, differing principally in the tufted habit, and larger inflorescence. From its harsh rigid foilage, it may also be rated as of similar low value in pasture, being better adapted for large cattle than sheep. DISTRIBUTION IN NEW ZEALAND: SOUTH ISLAND: SUB-ALPINE LOCALITIES IN NELSON AND CANTERBURY, common.**

**Reference to Plate XLV., C: Fig. 1. Plant. 2. Spikelet. 3. Floret. 4, 4'. Nervation of empty glumes. 5. Nervation of flowering glume. 6. Nervation of Palea. 7. Scale.**

C. Poa anceps. *Forst.* Var. γ. *breviculmis.*

D. " " Var. δ. *densiflora.*

Order GRAMINEÆ.

*Genus, Poa; Sub-Order, Festucacea*

## 3.—POA ANCEPS, VAR. e. DE BILIS.

**SLENDER POA**

*(Plate XLVI. E.)*

POA ANCEPS, VAR DEBILIS, Kirk, M.S.

A LONG, slender, tufted grass. Perennial. *Culms* 12—16 inches high, smooth. *Leaves* longer than the culm, very narrow *sheaths* narrow; *ligule* very short. *Panicle* 4—5 i nches long, inclined, branches few, in distant pairs, capillary. *Spikele* narrow, 4—5 flowered, terminal near the ends of tl ie branches. *Empty glumes* 3-nerved. *Flowering glumes* 5-nerved, finel y scabridus and tufted with long flocculent hair at the base. *Palea* bifi d, 2-nerved. *Anthers* long. *Scale* oblique, acute. *Grain* narrow. DI STRIBUTION OF VAR. e. DEBILIS: NEW ZEALAND.

This very slender grass was discovered by Mr. T. F Kirk, F.L.S., near the hot springs in the Auckland district, and has probably been developed there under the peculiar circumstances of heat and moisture which pr evail in. that locality. It has been previously shewn, that the conditions mos t favourable to maximum growth with the New Zealand species of Poa, are unde r a temperate, or probably severe climate, at altitudes of 4—5000 feet, it may ther efore be assumed, that this weakly variety is the result of forcing, it can however only possess a local value, where from its large size and succulent habit, it will be readily eaten by stock, but from the peculiar circumstances of its forced and rapi growth, its nutrient value may be doubted. DISTRIBUTION IN NEW ZEALAND: NORTH ISLAND: HOT SPRINGS, AUCKLAND—Kirk.

Reference to Plate XLVI. E. Fig. 1. Plant. 2. Spikelet. 3. Floret. 4, 4'. Nervation of empty glumes. 5. Nervation of flowering glume. 6. Nervation of Palea. 7. Scale. 8, 8'. Grain, front and side views.

Order GRAMINEÆ.

*Genus, Poa; Sub-Order, Festucaceæ.*

## 3—POA ANCEPS, VAR. f. MINIMA.

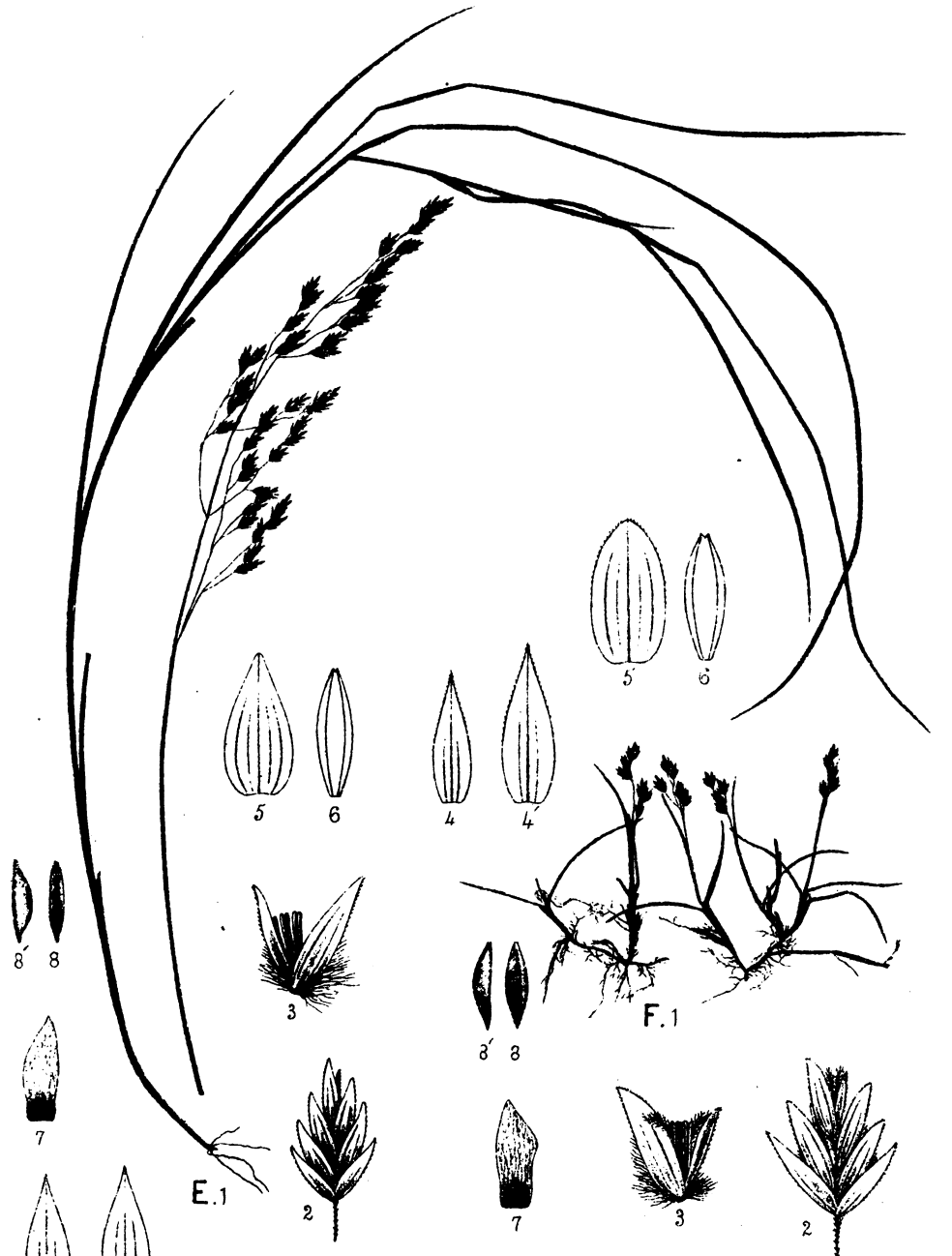
### MINUTE CREEPING POA.

*(Plate XLVI. F.)*

A VERY small creeping rooted grass. Perennial. *Culms* 1—2 inches high, smooth. *Leaves* few, shorter than the culms, very narrow, strict; spreading sheaths, striated; *ligule* very short. *Panicle* erect, ½—¾ inch long, spikelets 3—5 shortly branched. *Spikelets* ⅛ inch long, flat, 3—4 flowered. *Empty glumes* 3-nerved. *Flowering glume* 5-nerved, finely scabridus and tufted, with long flocculent silky hair at the base. *Palea* bifid, 2-nerved. *Anthers* long. *Scale* oblique, acute. *Grain* stout, oblong. DISTRIBUTION OF VAR. f. MINIMA: NEW ZEALAND.

This peculiar creeping rooted little grass, might almost be considered as a good species. It was discovered among the roots of larger grasses, collected by Mr. A. Mackay, on Mount Arthur, at an altitude of 4—200 feet, some of which were also varieties of *Poa anceps*, and attaining an unusual size in this locality. The diminutive size of the present variety, cannot therefore be ascribed to rigour of climate at this altitude, but more probably, to a well marked inherent tendency in this species, to vary under all circumstances. DISTRIBUTION IN NEW ZEALAND: SOUTH ISLAND: MOUNT ARTHUR (4—200 feet)—A. Mackay.

Reference to Plate XLVI. F.: Fig. 1. Plant. 2. Spikelet. 3. Floret. 4, 4'. Nervation of empty glumes. 5. Nervation of flowering glume. 6. Nervation of Palea. 7. Scale. 8, 8'. Grain, front and side view.




E. Poa anceps *Forst.* Var. ϵ. *debilis.*

F. " " Var. ζ. *minima.*

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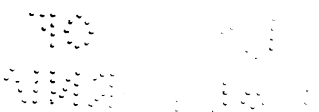


Order GRAMINEÆ.

*Genus, Poa; Sub-Order, Festucaceæ.*

## 4.—POA AUSTRALIS, VAR. LÆVIS.

### TUSSAC POA.

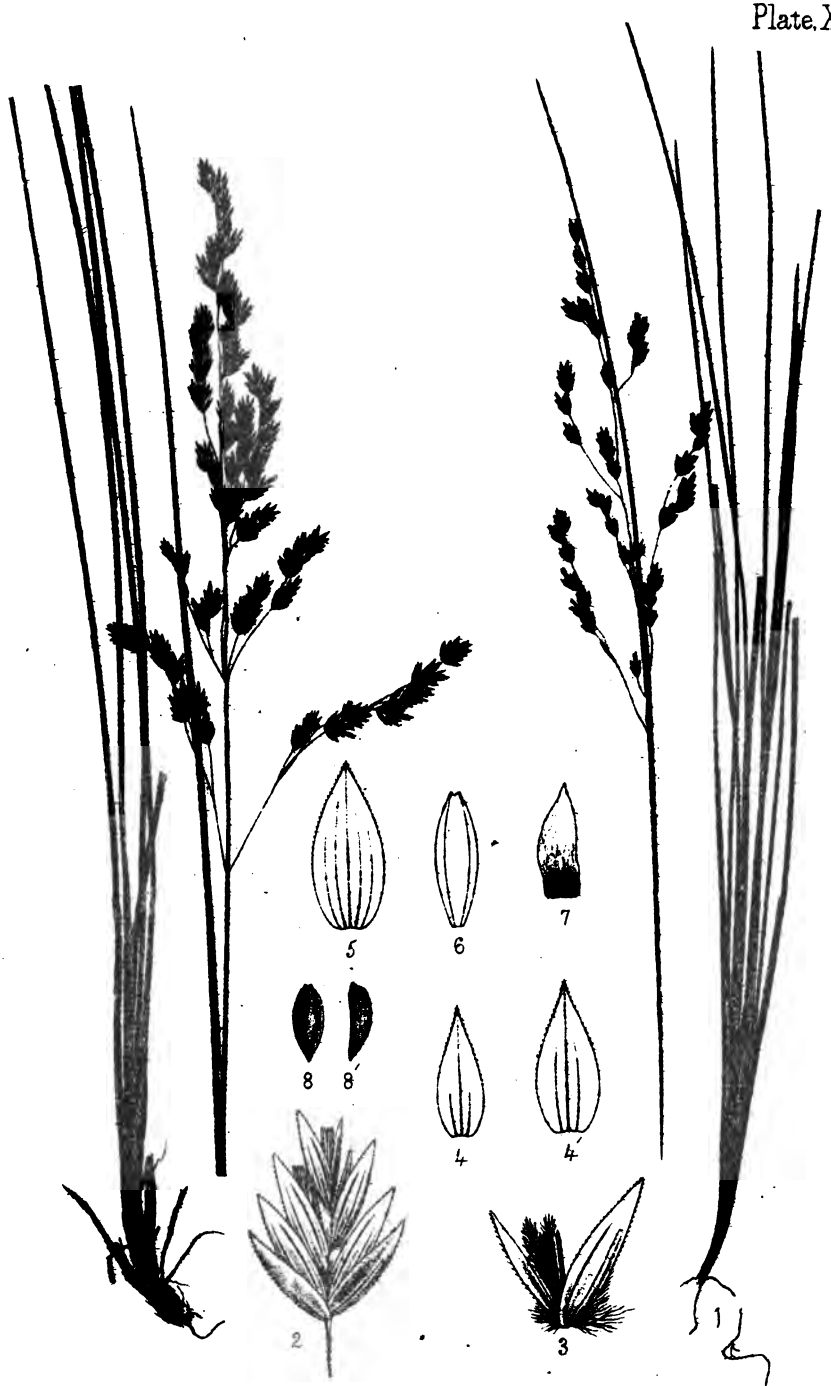
*(Plate XLVII.)*

POA CÆSPITOSA, Forster, Benth., Flora Austral. VII., 651. POA AUSTRALIS, R. Brown, *var. lævis*, Hook. fil. Fl. N.Z. I., 307. POA AUSTRALIS, R. Brown, *var. laevis*, Hook. fil. Handb. Fl. N.Z. I., 339.

A LARGE tussac grass, from sea level to 3000 feet altitude. Perennial. *Culms* densely tufted, 1—3 feet high, slender, smooth. *Leaves* longer or shorter than the culms, filiform, involute, rigid; *sheaths* narrow, smooth; *ligule* 0. *Panicle* erect, 2—8 inches long, branches few, capillary, whorled. *Spikelets* few, scabridus, $\frac{1}{8}$—$\frac{1}{4}$ inch long, 4—6 flowered, *Empty glumes* 3-nerved. *Flowering glume* 5-nerved. *Palea* bluntly bifid, 2-nerved. *Scale* oblique, acute. *Grain* stout. DISTRIBUTION OF SPECIES: AUSTRALIA, TASMANIA, NEW ZEALAND.

An extremely variable grass which has received different names by authors. It is not surprising, therefore, under such circumstances, that various estimates have been made of its value as food for stock, according to which variety prevailed in any district, some of the varieties being much more valuable than others. There is no doubt but that the true value of the larger tussac grasses, among which the present occupies a prominent place, has been much under estimated, as they have never been treated fairly on their merits, and conclusions based on the readiness with which stock eat or refuse them, cannot be accepted as a criterion of their value, unless they are cut down when in flower, and treated as fodder. It is well known, that even the most favourite grasses of cultivation such as *Lolium perenne*, the common Ray grass, if left uncut till the seed is shed, will be refused by all kinds of stock, and so it is with the present species, which should always be treated as a fodder plant. DISTRIBUTION IN NEW ZEALAND: Common in both ISLANDS, except in AUCKLAND NORTH.

Reference to Plate XLVII: Fig. I. Plant. 2. Spikelet. 3. Floret. 4, 4'. Nervation of empty glumes. 5. Nervation of flowering glume. 6. Nervation of Palea. 7. Scale. 8, 8'. Grain, front and side view.




. Poa australis. *Br.* Var. lævis.

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Order GRAMINEÆ.

*Genus, Poa; Sub-Order, Festucaceæ,*

## 5.—POA INTERMEDIA, n.s.

**SMALL TUSSAC POA.**

*(Plate XLVIII. A.)*

A SMALL tufted, or tussac grass, from near sea level to 5000 feet altitude. *Flowers* December—March. Perennial. *Culmns* 4—30 inches high, smooth, slender, grooved. *Leaves* as long as or shorter than the culms, erect, involute, filiform; *sheaths* grooved, with a large membranous sheathing ligule, in the tussac forms ligule small. *Panicle* ovate, 1—5 inches long, of few capillary branches, each, bearing 2—6 large, elongate, flat spikelets. *Spikelets* $\frac{1}{3}$ inch long, 4—7 flowered. *Empty glumes* 3-nerved. *Flowering glume* scabridus and villous at back, 5-nerved. *Palea* 2-fid, 2-nerved. *Scales* oblique, acuminate. *Anthers* long. DISTRIBUTION OF SPECIES: NEW ZEALAND.

**A valuable nutritious pasture grass, very variable in size according to soil and situation, and which is widely distributed in the South Island, and also, though less abundantly, in the North Island. In its larger tussac form, it has hitherto been confounded with *Poa Australis Br. var. lævis*, and its numerous smaller forms with *Poa Colensoi* Hook. fil. Always retaining, however, the open panicle and membraneous sheathing ligule of the latter, with the large spikelets of *Poa anceps* varieties, thus proving its position as an intermediate species connecting this group. This grass possesses a large adaptation to circumstances of climate and soil, proving equally permanent on rich alluvial soil and on dry gravel terraces, although on the latter it is stunted and less nutritious. It is also found to attain a large size, at altitudes of 4—5000 feet, and it may, therefore, be considered as one of the most valuable permanent pasture grasses in New Zealand. It is also worthy of cultivation as fodder. DISTRIBUTION IN NEW ZEALAND: NORTH ISLAND: AUCKLAND—Kirk; WELLINGTON—Buchanan; TARARUA MOUNTAINS, (5000 feet)—H. H. Travers. SOUTH ISLAND: NELSON, (3—500 feet)—H. H. Travers; MOUNT ARTHUR, (4—200 feet)—A. Mackay; DUNEDIN DISTRICT, LAKE DISTRICT, and SOUTHLAND—Buchanan.**

Reference to Plate XLVIII. A.: Fig. 1. Plant. 2. Spikelet. 3. Floret. 4, 4'. Nervation of empty glumes. 5. Nervation of flowering glume. 6. Nervation of Palea. 7. Scale.

Order GRAMINEÆ.

*Genus, Poa; Sub-Order, Festucaceæ.*

# 6.—POA COLENSOI.

**COLENSO'S POA.**

*(Plate XLVIII., B.)*

POA COLENSOI, Hook. fil. Handb. Fl. N.Z., I., 340.

A SAMLL tufted grass, from near sea level to 6000 feet altitude. *Flowers* December—February. Perennial. *Culms* 1—10 inches high, smooth, slender, grooved. *Leaves* much shorter than the culms, usually curved and straggling, involute, filiform; *sheaths* grooved, with a large membranous sheathing ligule. *Panicle* 1—2 inches long, broadly ovate, of few capillary spreading branches, each bearing 1 or 2 broad flat spikelets. *Spikelets* $\frac{1}{6}$ inch long, 3--4 flowered. *Empty glumes* 3 nerved. *Flowering glumes* ovate, acuminate, 5-nerved, scabridus, and with short hairs at the base. *Palea* 2-fid, 2-nerved. *Scales* oblique, narrow, accuminate. *Anthers* long. *Grain* smooth, linear. DISTRIBUTION OF SPECIES: NEW ZEALAND.

The New Zealand group of *Poas* having deep rooting tufts, and among which the present species is included, occupy an important place in the pastures of New Zealand. They all possess in virtue of this root structure, a highly recuperative power after apparent destruction by drought or fire, which should recommend them as permanent grasses, in preference to many introduced species having surface spreading roots, and which are better adopted for rotation crops. The grass under notice is everywhere closely cropped by all kinds of stock, and even in the absence of any analysis, may be accepted as a grass of first-class quality. DISTRIBUTION IN NEW ZEALAND: NORTH ISLAND: RUAHINE MOUNTAINS—Colenso: TARARUA MOUNTAINS--H. H. Travers. SOUTH ISLAND: NELSON—Sinclair, Munro, Travers, Kirk; RANGITATA RANGE, (2—5000 feet)—Sinclair, Haast, Kirk, Armstrong; OTAGO LAKE DISTRICT —Hector and Buchanan; DUNEDIN DISTRICT and SOUTHLAND—Buchanan.

Reference to Plate XLVIII., B. Fig. 1. Plant. 2. Spikelet. 3. Floret. 4, 4'. Nervation of empty glumes. 5. Nervation of flowering glume. 6. Nervation of Palea. 7. Scale. 8, 8' Grain, front and side views.

**A.** Poa intermedia, *n.s.*
**B.** " Colensoi, *Hook fil.*

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Order GRAMINEÆ.

*Genus, Poa; Sub-Order, Festucaceæ.*

## 7.—POA ACICULARIFOLIA, n.s.

**NEEDLE LEAVED POA.**

*(Plate XLIX. A.)*

A SMALL tufted, alpine grass, with wiry creeping roots at 5000 feet altitude. *Fowers* January—March. Perennial. *Culms* 3—6 inches high, very slender, capillary. *Leaves* $\frac{1}{4}$—$\frac{1}{3}$ inch long, rigid, with acicular tips, sheaths short; *ligule* short, sheathing, membranous. *Panicle* $\frac{1}{2}$—$\frac{3}{4}$ inch long, triangular, of 3—4 capillary spreading branches, each bearing 1 broad, flat, spikelet. *Spikelets* $\frac{1}{8}$ inch long, 2-flowered. *Empty glumes* ovate-acuminate, obtuse, 3-nerved. *Flowering glume* ovate-oblong, obtuse, 5-nerved, scabridus, and villous on the back. *Palea* 2-fid, 2-nerved. *Scales* oblique, acute. *Anthers* long. DISTRIBUTION OF SPECIES: NEW ZEALAND.

This peculiar little plant has previously been considered as only a variety of *Poa Colensoi*, to which it bears a general resemblance, but differing in the short, rigid, acicular leaves, fewer flowered spikelets, and shorter anthers, and presenting a remarkably alpine character; it may be considered as a rare plant, although pretty widely distributed, and from its short rigid foliage, must rank very low as a pasture plant, it may therefore be relegated to the herbarium, as an interesting botanical curiosity. DISTRIBUTION IN NEW ZEALAND: NORTH ISLAND: TARARUA MOUNTAINS, (5000 feet)—J. Mitchell, H. H. Travers. SOUTH ISLAND: NELSON MOUNTAINS, (5000 feet)—H. H. Travers; MOUNT ARTHUR, (4200 feet), and MOUNT COOK, (6000 feet)—A. Mackay; CANTERBURY MOUNTAINS—Kirk; ENYS—Armstrong.

Reference to Plate XLIX., A.: Fig. 1. Plant. 2. Spikelet. 3. Floret. 4, 4'. Nervation of empty glumes. 5. Nervation of flowering glume. 6. Nervation of Palea. 7. Scale. 8, 8'. Grain, front and side views.

Order GRAMINEÆ.

*Genus, Poa; Sub-Order, Festucacœ.*

## 8.—POA UNIFLORA, n.s.

**ONE FLOWERED POA.**

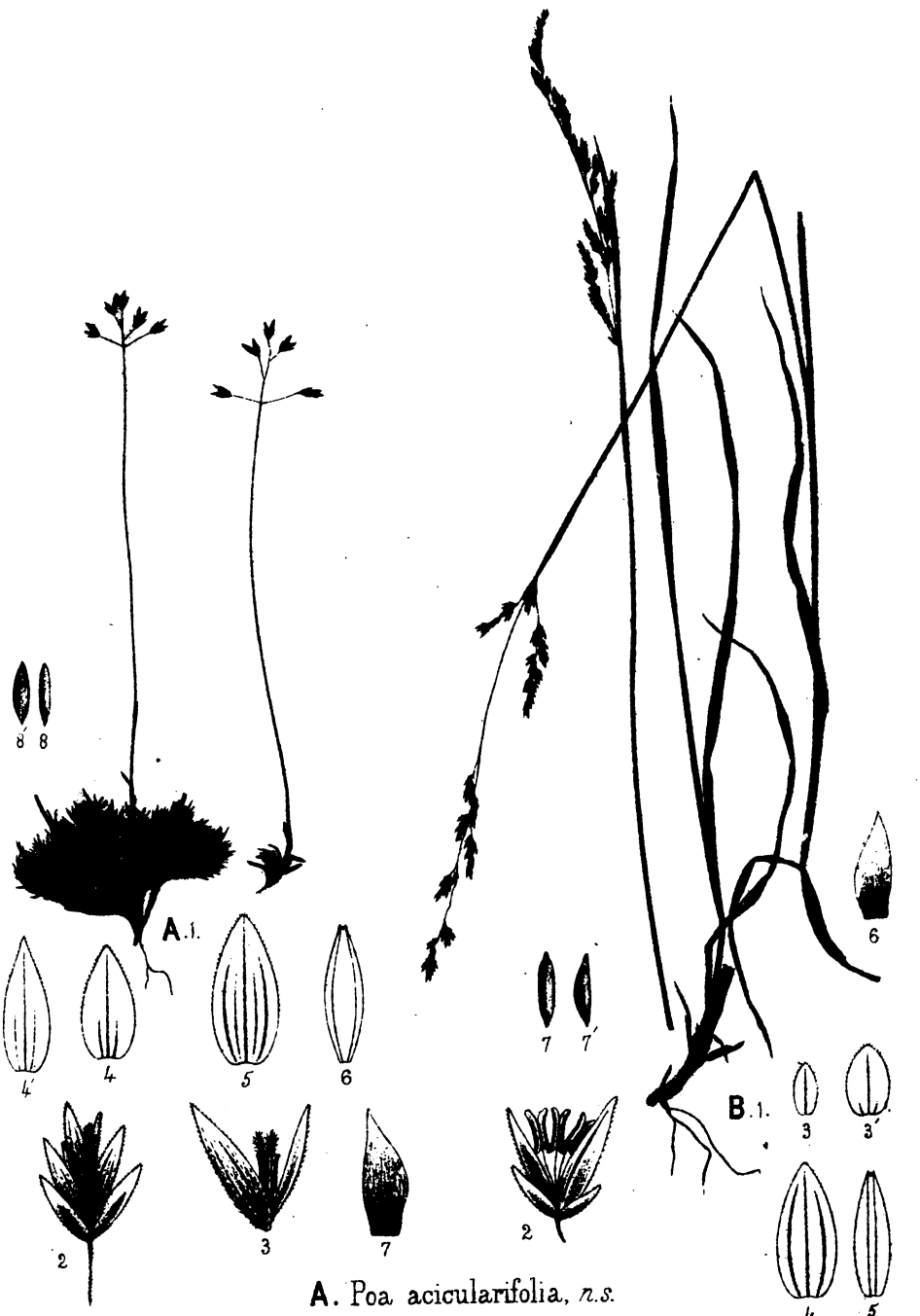
*(Plate XLIX., B.)*

POA AFFINIS, R. Brown, *var. B. agrostoidea?* N.Z. Flora., I., 307.

A TUFTED, glabrous, sub-alpine grass, ascending to 4,200 feet. *Flowers* December—March. Perennial. *Culms* 12—20 inches high, glabrous. *Leaves* brownish green, shorter than the culms, flat, $\frac{1}{10}$ inch broad; *sheaths* striated; *ligule* long, acute. *Panicle* elongate, narrow, of few short branches. *Spikelets* small, 1-flowered. *Empty glumes* glabrous, very short, obtuse, largest 3-nerved. *Flowering glume* glabrous, elongate, obtuse, 3-nerved. *Palea* 2-fid, 2-nerved. *Scales* oblique, acute. *Anthers* long, stout. DISTRIBUTION OF SPECIES: NEW ZEALAND.

The present species recently discovered by Mr. A. Mackay, of the Geological Survey, may at once be distinguished from all other New Zealand species of *Poa*, by its one flowered spikelets; while its bulk and succulent habit, will recommend it as a valuable addition to the pasture grasses of New Zealand. Numerous specimens of several other genera were also collected at the same time, chiefly on the Mount Arthur range of mountains, at an elevation of 4—5000 feet. In every case these specimens showed a luxuriant growth, proving the existence of a rich and varied pasture, combined with a bulk unusual at such high altitudes; several species attaining a height of 3—4 feet. The presence of a limestone formation and abundant moisture explains this remarkable growth. Such localities are, no doubt, well adapted for grazing purposes during summer, and might even be utilised to the extent of dairy farming, as practised on the European alps, where the cows are driven up the valleys in spring, and removed with the produce of the season in the form of cheese and butter, on the approach of winter. Roads, however, must necessarily be formed before anything but stock for fattening purposes can be driven in such localities. DISTRIBUTION OF SPECIES IN NEW ZEALAND: MOUNT ARTHUR, (4,200 feet altitude)—A. Mackay.

Reference to Plate XLIX., B. Fig. 1. Plant. 2. Spikelet. 3—3'. Nervation of empty glumes. 4. Nervation of Flowering glume. 5. Nervation of Palea. 6. Scale. 7, 7'. Grain, front and side views.




**A.** Poa acicularifolia, *n.s.*
**B.** uniflora . *n.s.*

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Order GRAMINEÆ.

*Genus, Poa; Sub-Order, Festucaceæ.*

## 9 —POA PYGMÆA, n.s.

**DWARF POA.**

*(Plate L., A.)*

A SMALL patch grass, rooting from the prostrate branches, found at 4—6000 feet altitude. *Flowers* January—February. Perennial. *Culms* ⅓ inch long, terminating branches 1 inch long, the latter densely clothed with short leaves. *Leaves* ⅓ inch long, involute, rigid, with acicular tips; *ligule* short, truncate. *Panicle* racemose, of 1—3 spikelets. *Spikelets* large, short, broad, finely scabridus, 2—3 flowered. *Empty glumes* 3-nerved. *Flowering glume* 5-nerved and shortly villous at base. *Palea* 2-fid, 2-nerved. *Scales* oblique, acute. Anthers long. DISTRIBUTION OF SPECIES: NEW ZEALAND.

This curious little patch grass, according to Mr. Petrie who first discovered it, is abundant on Mount Pisa, in the Lake district, Otago, at an altitude of 4—6000 feet, it is closely allied in the structure of its inflorescence, to varieties of *Poa anceps;* but the absence of flocculent silky hair at the base of the flowering glume, disunites it from this group, and the dense leafy habit of the branches, is entirely different from every known New Zealand *Poa*. From the short rigid growth of this grass, it can only be of value as food for sheep; and from the close structure of its branches, which peculiarly adapts it to resist the destructive effects both of frost and fire, it may prove very permanent in mountain pasturage. DISTRIBUTION IN NEW ZEALAND: SOUTH ISLAND: MOUNT PISA, (4—6000 feet altitude)—W. Petrie.

Reference to Plate L., A: Fig. 1. Plant. 2. Spikelet. 3. Floret. 4, 4'. Nervation of empty glumes. 5. Nervation of flowering glume. 6. Nervation of Palea. 7. Scale.

Order GRAMINEÆ.

*Genus, Poa; Sub-Order, Festucaceæ.*

# 10.—POA EXIGUA.

**LITTLE POA.**

*(Plate L., B.)*

POA EXIGUA, Hook. fil. Handb. Fl. N.Z., I., 338.

A VERY small tufted, glabrous, alpine grass, found at 5—6000 feet altitude. *Culms* 1—1½ inches high; *sheaths* membranous; *ligule* short, *Leaves* involute, erect, obtuse, acicular, ½—⅔ inch long. *Panicle* racemose, ¼—⅓ inch long, of 4—8 spikelets. *Spikelets* ½ inch long, pale purple, 2-flowered, shortly pedicelled. *Empty glumes* 1 and 3-nerved. *Flowering glume* roundish, with broad membranous margins, 5-nerved, finely scabridus and shortly villous at base. *Palea* scarcely bifid, 2-nerved. *Scales* oblique, obtuse. *Grain* stout. DISTRIBUTION OF SPECIES: NEW ZEALAND.

**The above description is chiefly made from a fragment of the plant originally described and named by Dr. Hooker. Additional specimens of this species have been recently collected by Mr. Petrie on Mount Pisa, Otago, at 4000 feet altitude, which differ chiefly in larger size and more numerous spikelets. A short ligule is also distinctly present in the membranous sheath. Both specimens are figured in Plate L. In its affinity, this grass approaches *Poa anceps* varieties, in the short villous tufts at the base of the flowering glume, and general facies of the plant. In its larger forms, it has a very close growth of soft succulent leaves, arising from prostrate branches, forming a thick short sward, and will probably prove to be a valuable sheep grass. DISTRIBUTION IN NEW ZEALAND: SOUTH ISLAND: LAKE DISTRICT, OTAGO, (6000 feet)—Hector and Buchanan; MOUNT PISA, OTAGO, (4000 feet)—Petrie.**

Reference to Plate L., A.: Fig. 1, 1′. Plants. 2. Spikelet. 3. Floret. 4, 4′. Nervation of empty glumes. 5. Nervation of flowering glume. 6. Nervation of Palea. 7. Scale. 8, 8′. Grain, front and side views.

Order GRAMINEÆ

*Genus, Poa; Sub-Order, Festucaceæ.*

## 11.—POA ALBIDA, n.s.

**WHITE FLOWERED POA.**

*(Plate L., C.)*

POA ANCEPS, var. E., alpina, Handb. Fl., N.Z., I., 339.

A SMALL tufted, deeply rooting, greenish-white grass, found at 4—6000 feet altitude. *Flowers* December—February. Perennial. *Culms* 4—6 inches high, smooth, stout. *Leaves* shorter than the culms, 1—2 inches long, involute, rigid, decussate, tips acicular, grooved and scabrid on the ridges; *sheaths* deeply grooved and scabrid; *ligule* short, truncate. *Panicle* much contracted, nearly white when dry, 1—2 inches long, of several short branches, densely flowered. *Spikelets* very small, short, broad, scabridus, 2—3 flowered. *Empty glumes* 3-nerved. *Flowering glume* 5-nerved. *Palea* bifid, 2-nerved. *Scales* oblique, acuminate. *Anthers* short. *Grain* sharply pointed, and bent inward at the top. DISTRIBUTION OF SPECIES: NEW ZEALAND.

This peculiar little alpine grass is described in the Handbook of the Flora of New Zealand as a variety of *Poa anceps*, with a note added by the author, "that it may perhaps prove a different species." An examination of its details confirms this opinion, and it has therefore been described as a distinct species. The long flocculent silky hair at the base of the flowering glume and long anthers, so characteristic of *Poa anceps* varieties, being both absent. The rigid, harsh herbage of this little grass, does not recommend it to favourable notice, as it will probably prove unpalatable to stock. DISTRIBUTION IN NEW ZEALAND: SOUTH ISLAND: SNOW HOLES ON MOUNT DARWIN, ascending to 6000 feet on MOUNT DOBSON—Haast; NELSON MOUNTAINS (5000 feet) H. H. Travers.

Reference to Plate L., C.: Fig. 1. Plant. 2. Spikelet. 3. Floret. 4. Nervation of empty glumes. 5. Nervation of flowering glume. 6. Nervation of Palea. 7. Scale. 8, 8′. Grain, front and side views.

A. Poa pygmæa, *n.s.*
B. " exigua, *n.s.*
C. " albida, *n.s.*

UNIV. OF CALIFORNI

Order GRAMINEÆ.

*Genus, Poa; Sub-Order, Festucaceæ.*

## 12.—POA MACKAYI, n.s.

**BROWN MOUNTAIN POA.**

*(Plate LI., A.)*

A TUFTED, brownish green, alpine grass, found at 4—5000 feet altitude. *Flowers* January—March. Perennial. *Culms* 8—14 inches high, smooth and grooved. *Leaves* shorter than the culms, erect, flat. *Sheaths* grooved; *ligule* long, acute. *Pancicle* erect, 3—4 inches long, ovate, of few branches in distant pairs, having a few large spikelets at the extremities. *Spikelets* ¼ inch long, nearly as broad, 3- 4 flowered. *Empty glumes* 3-nerved. *Flowering glumes* scabridus on the nerves only, tipped purple, 5-nerved, and with a small tuft of flocculent silky hair at the base. *Palea* 2-fid, 2-nerved. *Scales* oblique, tapering, obtuse. *Anthers* short. *Grain* long, linear. DISTRIBUTION OF SPECIES: NEW ZEALAND.

A showy grass with brownish green leaves and purple tipped glumes, presenting, when in flower, a very striking aspect amongst the alpine flora of the Tararua and Mount Arthur mountains, where it is found in large patches of close growing tufts, resembling a cultivated crop. This grass has been grown successfully in pots at Wellington, by Mr. H. H. Travers, and from its bulk and succulent habit, it can be recommended as a grass which would likely re-pay the trouble and expense of its cultivation. In a systematic point of view, it connects *Poa anceps* varieties with *Poa Kirkii*, *Poa breviglumis*, and *Poa imbecilla*. DISTIBUTION OF SPECIES IN NEW ZEALAND: NORTH ISLAND: TARARUA MOUNTAINS, (5000 feet altitude)—H. H. Travers. SOUTH ISLAND: MOUNT ARTHUR RANGE, (4,200 feet altitude)—A. Mackay.

Reference to Plate LI., A.: Fig. 1. Plant. 2. Spikelet. 3. Floret. 4, 4'. Nervation of empty glumes. 5. Nervation of flowering glume. 6. Nervation of Palea. 7. Scale. 8, 8'. Grain, front and side views.

Order GRAMINEÆ.

*Genus, Poa; Sub-Order, Festucaceæ.*

## 13.—POA KIRKII, n.s.

**KIRK'S POA.**

*(Plate LI., B.)*

(?) POA PURPUREA, Kirk, (undescribed) Trans. N.Z. Inst., IX., 500.

A TUFTED, brownish-green, alpine grass, found at 3—4000 feet altitude. *Flowers* January—March. Perennial. *Culms* 12—14 inches high, smooth, grooved. *Leaves* shorter than the culms, erect, flat; *sheaths* grooved; *ligule* long, acute. *Panicle* erect, 3—4 inches long, ovate, branches whorled, capillary, with numerous small spikelets. *Spikelets* $\frac{1}{8}$ inch long, 3—4 flowered. *Empty glumes* 3-nerved. *Flowering glumes* very obtuse, scabridus, 5-nerved, tipped with purple, and without hairs at the base. *Palea* 2-fid, 2-nerved. *Scales* oblique, acuminate. *Grain* long, linear. DISTRIBUTION OF SPECIES: NEW ZEALAND.

This species is closely allied to *Poa Mackayi* and *Poa breviglumis*, but differs much in the inflorescence from both. It is supposed to be the same grass as one first discovered on the mountains of the Clarence Valley, by Mr. Kirk, but the specimens from which the above description is taken were more recently collected on the Mount Arthur range, by Mr. A. Mackay. The M.S. name originally suggested by Mr. Kirk, "*Poa purpurea,*" but without any description of the plant, although appropriate as to colour, might produce confusion, inasmuch as several other species of *Poa* are also purple. Mr. Kirk says of his plant, "that it is eaten alike by horses, cattle, and sheep, and appears well adapted for mixed pasturage on cool lands." DISTRIBUTION IN NEW ZEALAND: SOUTH ISLAND: CLARENCE VALLEY, (3—4000 feet)—Kirk; MOUNT ARTHUR (4,200 feet)—A. Mackay.

Reference to Plate LI., B.: Fig. 1. Plant. 2. Spikelet. 3. Floret. 4, 4'. Nervation of empty glumes. 5. Nervation of flowering glume. 6. Nervation of Palea. 7. Scale. 8, 8'. Grain front and side views.

A. Poa McKayi *n.s.*

B. " Kirkii, *n.s.*

CALIFORNIA

Order GRAMINEÆ.

*Genus, Poa; Sub-Order; Festucaceæ.*

# 14.—POA LINDSAYI.

**BROWN FLOWERED POA.**

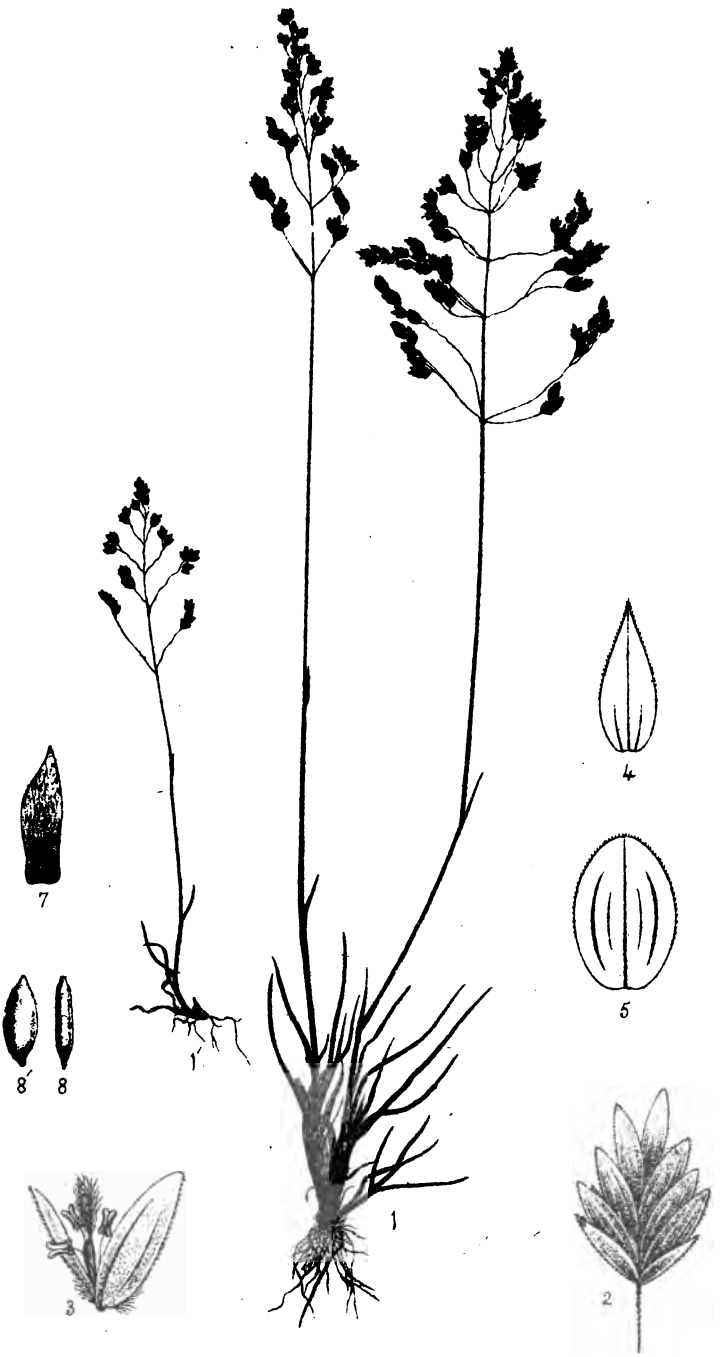
*(Plate LII.)*

POA LINDSAYI, Hook. fil. Handb. Fl. N.Z. I., 340.

A SMALL tufted sub-alpine grass, found from 500—4000 feet altitude. *Flowers* December—February. Perennial. *Culms* 3—12 inches high, erect, slender. *Leaves* ½—4 inches long, flaccid, very narrow, flat, subulate, sheathing leaves very short; *ligule* short, obtuse, or lacerate. *Panicle* ovate, open, 1—7 inches long, branches capillary, 2 or 3 nate, distant, often flexuose, lower ½—1½ inches long. *Spikelets* few, subterminal on the branches, 4—8 flowered, brownish-green. *Empty glumes* 3-nerved. *Fowering glume* 5-nerved, inner pair faint, scabridous, border membranous, sprinkled with short hairs near the base. *Palea* bifid, 2-nerved. *Scale* oblique, acute. *Anthers* short. *Grain* linear. DISTRIBUTION OF SPECIES: NEW ZEALAND.

**This beautiful little grass is abundant on the sub-alpine pasture grounds of the South Island, where from its close tufted habit, and large capacity of seeding, it proves very permanent. This forms one of many valuable sheep grasses, which from their small size, are little noticed except when in flower, yet but for their presence, the feeding capacity of many districts would be very poor. The permanence of some of the smaller *Poas*, among which the present must be included, is most markedly shewn by their increase on road cuttings, near fences, or wherever the ground is disturbed. This would indicate, that a very small amount of cultivation would increase them abundantly. DISTRIBUTION IN NEW ZEALAND: SOUTH ISLAND: SADDLE HILL, OTAGO—Lindsay; LAKE DISTRICT—Hector and Buchanan, Petrie; ACHERON VALLEY, CANTERBURY, (4000 feet)—Travers; KOWAI VALLEY, (2—3000 feet)—Haast.**

Reference to Plate LII: Fig 1. Plant. 2. Spikelet. 3. Floret. 4, 4′. Nervation of empty glumes. 5. Nervation of flowering glume. 6. Nervation of Palea. 7, Scale. 8, 8′. Grain, front and side views.




Poa Lindsayi, *Hook.fil.*

UNIV. OF CALIFORNIA

Order GRAMINEÆ.

*Genus, Poa; Sub-Order, Festucaceæ.*

## 15.—POA BREVIGLUMIS.

**SHORT GLUMED POA.**

*(Plate LIII., A.)*

POA BREVIGLUMIS, Hook. fil., Fl. Antarct., I., 101. POA BREVIGLUMIS, Hook. fil., Handb. Fl. N.Z., I. 337.

A SMALL tufted grass, found from sea level to 1000 feet altitude. *Flowers* December—February. Perennial. *Culms* 10—16 inches high, erect, decumbent at the base, smooth. *Leaves* much shorter than the culms, very narrow, flat, soft; *sheaths* striated; *ligule* oblong, membranous. *Panicle* erect, 3—5 inches long, open, branches capillary, in distant pairs or ternate. *Spikelets* few, pedicelled near the ends of the branches, glabrous, green, 3—4 flowered. *Empty glumes* 1 and 3-nerved. *Flowering glume* with 5 scabridous nerves. *Palea* bifid, 2-nerved. *Scale* oblique, acute. *Anthers* short. DISTRIBUTION OF SPECIES: CAMPBELL ISLAND, NEW ZEALAND.

This species is closely allied to *Poa Kirkii*, but generally found with a much larger open panicle and smaller spikelets. When found on good soil, it might easily be mistaken for a small green spikelet variety of that grass. It is a grass chiefly of maritime habits, but is also common inland on low hills. It passes insensibly into the next species, *Poa imbecilla*, by an appparent depauperation, produced by poverty of soil; but, in its larger forms, is a distinct species, and sufficiently bulky to constitute it a valuable grass. DISTRIBUTION IN NEW ZEALAND: COMMON IN BOTH ISLAND IN MARITIME SITUATIONS, AND ON INLAND HILLS.

Reference to Plate LIII., A.: Fig. 1. Plant. 2. Spikelet. 3. Floret. 4, 4'. Nervation of empty glumes. 5. Nervation of flowering glume. 6. Nervation of Palea. 7. Scale. 8, 8.' Grain, front and side views.

Order GRAMINEÆ.

*Genus, Poa; Sub-Order, Festucaceæ.*

# 16.—POA IMBECILLA.

**WEAK STEMMED POA.**

*(Plate LIII., B.)*

ERAGROSTIS IMBECILLA, Bentham, Fl. Austral., VII., 643. POA IMBECILLA, Forster, Hook. fil., Fl. N.Z., I., 306. POA IMBECILLA, Forster, Hook. fil., Handb. Fl. N.Z., I., 337.

A VERY weak, slender, tufted grass, common in woods. *Flowers* November—January. *Culms* weak, decumbent, 6—12 inches long. *Leaves* very narrow, much shorter than the culms, flat; *ligule* short. *Panicle* 3—6 inches long, narrow, open, with few distant pairs or whorls of capillary branches. *Spikelets* few, pedicelled, terminal on the branches, glabrous, green, 3—8 flowered. *Empty glumes* 3-nerved. *Flowering glume* 5-nerved. *Palea* bifid, 2-nerved. *Scale* oblique. *Anthers* short. DISTRIBUTION OF SPECIES: AUSTRALIA, NEW ZEALAND.

A distinct grass from the last species in its smaller flaccid forms, but connected by varieties. It is a grass of shaded places, and has little to recommend it as a pasture plant. This grass is one of a small group allied to *Poa anceps*, of which *Poa Mackayi* forms the connecting link. It might have been more systematic to have arranged this group as varieties of *Poa Mackayi*, similar to *Poa anceps* varieties, and distinguished them by the absence of flocculent silky hairs at the base of the flowering glume and short anthers; but as this has been done in the key to the species, the retaining specific names will conduce more to their easy discrimination. DISTRIBUTION IN NEW ZEALAND: NOT UNCOMMON IN SHADED PLACES IN BOTH ISLANDS.

Reference to Plate LIII., B.: Fig. 1. Plant. 2. Spikelet. 3. Floret. 4, 4'. Nervation of empty glumes. 5. Nervation of flowering glume. 6. Nervation of Palea. 7. Scale.

**A.** Poa breviglumis, *Hook.fil.*

**B.** " imbecilla, *Forst.*

Order GRAMINEÆ.

*Genus, Festuca; Sub-Order, Festucaceæ.*

## GENUS XXIII.—FESTUCA, Linnæus.

*Spikelets* pedicelled, several flowered; racemose, panicled, or spiked. *Empty glumes*, 2 unequal, rounded at the back, bifid, awnless or awned between the lobes. *Palea* 2-nerved, nerves ciliate. *Scales* 2, notched. *Stamens* 3. *Grain* glabrous, free or adherent to the palea. DISTRIBUTION OF GENUS: TEMPERATE AND MOUNTAINOUS REGIONS OF BOTH HEMISPHERES. *Etymology:* A Latin name of doubtful derivation.

## 1.—FESTUCA LITTORALIS, VAR. TRITICOIDES.

**SAND HILL FESCUE GRASS.**

*(Plate LIV.)*

ARUNDO TRIODIOIDES, Trinius, Spec. Gram., t. 51. POA LITTORALIS, Labill, Pl. Nov. Holl., I., 22, t. 27. SCHENODORUS LITTORALIS, Beauv, Agrost, 99. SCHENODORUS LITTORALIS, Beauv (var. *triticoides,)* Bentham, Fl. Austral., VII., 655. FESTUCA LITTORALIS, R. Brown, Hook. fil. Handb., Fl. N.Z., I., 341.

A TALL densely tufted littoral grass. *Flowers* December—February. *Culms* 1—3 feet high, leafy, smooth and shining. *Leaves* erect, rigid, involute, terete, pungent, longer or shorter than the culm; *sheaths* striated; *ligule* very short. *Panicle* narrow, 3—10 inches long, branches short alternate, erect. *Spikelets* flat, ovate, $\frac{1}{2}$—$\frac{3}{4}$ inch long, 4—8 flowered, straw-coloured. *Empty glumes* acuminate, 5-nerved. *Flowering glumes* ovate, acuminate, bifid at top, with a very short intermediate awn, 7-nerved. *Palea* bifid, 2-nerved. *Scales* deep and acutely 2-fid. *Grain* ovate, smooth, grooved in front. DISTRIBUTION OF SPECIES: AUSTRALIA, TASMANIA, NEW ZEALAND.

**Varieties of the present species are abundant on the coasts of New Zealand, where they are of great value in assisting to bind drifting sand. The plant figured here is evidently the var. *triticoides*, Bentham, of Western Australia.**

This variety is probably the most common on the shores of New Zealand, although the smaller sized species common in Eastern Australia is also found near Wellington, and probably in many other places in New Zealand. The variety *triticoides* may always be distinguished by its greater size—5-nerved empty glumes, and 7-nerved flowering glume. It must, from its superior size, be the most valuable as a sand binder. These grasses can have little value as food plants, unless cut when they are in flower; and although succulent at this time, are so sprinkled with sand as to be unfit for food. This is to be regretted, as all littoral grasses contain a considerable amount of soda in their sap secretions, which is invaluable to the health of stock. DISTRIBUTION IN NEW ZEALAND: ABUNDANT EVERYWHERE IN BOTH ISLANDS, ON DRIFT SANDS NEAR THE SEA.

Reference to Plate LIV.: Fig. 1. Plant. 2. Spikelet. 3. Floret. 4, 4′. Nervation of empty glumes. 5. Nervation of flowering glume. 6. Nervation of Palea. 7. Scale. 8, 8′. Grain, front and side view.

Festuca *(Schedonorus)* littoralis, var. triticoides.

Order GRAMINIEÆ.

*Genus, Festuca; Sub-Order, Festucaceæ.*

## 2.—FESTUCA SCOPARIA.

**POA-LIKE FESCUE.**

*(Plate LV., A.)*

FESTUCA SCOPARIA, Hook. fil., Fl. Antarct, I., 98. FESTUCA SCOPARIA, Hook. fil., Fl. N.Z., I., 308. FESTUCA SCOPARIA, Hook. fil. Handb., Fl. N.Z., I., 341.

A DENSELY tufted, fine-leaved, littoral grass. *Flowers* December—February. Perennial. *Culms* 6—20 inches high, leafy, glabrous. *Leaves* filiform, rigid, longer or shorter than the culm, sheathing leaves narrow; *ligule* very short. *Panicle* ½—3 inches long, ovoid or narrow, elongate, branches short, erect, alternate, or the lower pair sometimes opposite. *Spikelets* green, flattened, ¼—⅓ inch long. *Empty glumes* very unequal, 1 and 3-nerved. *Flowering glume* acuminate, 5-nerved. *Palea* nearly as long as the glume, bifid at the top, and 2-nerved. *Scale* acutely, 2-fid. *Grain* broad, concave in front. DISTRIBUTION OF SPECIES: AUCKLAND ISLANDS, CAMPBELL ISLAND, NEW ZEALAND.

A small *Poa*-like grass, growing generally on precipitous rocks; its abundance, more or less, depending on the presence of such habitats. The large sea-green cushions, of filiform leaves of this species, are very conspicious objects, and readily attract the attention. From the difficulty of reaching this grass, it is very improbable that it can be much grazed by other stock than sheep, for whom the fine foliage is well adapted. Under these circumstances it will chiefly possess a botanical interest. DISTRIBUTION IN NEW ZEALAND: NOT UNCOMMON ON ROCKY PARTS OF THE COAST OF BOTH ISLANDS.

Reference to Plate LV., A.: Fig. 1. Plant. 2. Spikelet. 3. Floret. 4, 4'. Nervation of empty glumes. 5. Nervation of flowering glume. 6. Nervation of Palea. 7. Scale. 8, 8'. Grain, front and side views.

Order GRAMINEÆ.

*Genus, Festuca; Sub-Order, Festucaceæ.*

## 3—FESTUCA DURIUSCULA, LINNÆUS.

**HARD FESCUE GRASS.**

*(Plate LV., B.)*

FESTUCA DURIUSCULA, Linnæus, Hook. fil., Fl. Tasm., II., 126. FESTUCA DURIUSCULA, Linnæus, Hook. fil., Fl. N.Z., I., 309. FESTUCA DURIUSCULA, Linnæus, Hook. fil., Handb. N.Z. Fl., I., 341.

A TALL, slender, densely tufted grass. *Roots* fibrous. Perennial. *Flowers* December—February. *Culms*, 1—2 feet high, glabrous. *Leaves* slender, involute, filiform, or short and setaceous; *Sheaths* with membraneous wings; *ligule* very short. *Panicle* often unilateral, 1—7 inches long, open or contracted, branches capillary, often flexuose, lower 2 or 3-nate. *Spikelets* few, $\frac{1}{4}$—$\frac{1}{2}$ inch long, 4—8 flowered. *Empty glumes* unequal, acute, 3-nerved. *Flowering glume* ovate, lanceolate, shortly bifid, with a central short stiff awn, scabrid on the nerves. *Palea* nearly as long as the flowering glume, bifid at the top, 2-nerved. *Scale* acutely 2-fid and, in alpine forms, ciliate, ovary linear, crowned with a small glutinous patch without hairs. *Grain* linear, oblong, concave in front. DISTRIBUTION OF SPECIES: TEMPERATE REGIONS OF BOTH HEMISPHERES.

A very valuable grass, occuping a prominent place in all mountain pastures, being productive in every variety of soil, and possessing a great capacity of adaptation to both aridity and moisture. It is subject everywhere to much variation, and several of the varieties are known by other names. This tendency to vary, may also be observed with this species in New Zealand, sub-alpine forms sometimes being more related to *Festuca ovina* than the present species; and it is very improbable that these varieties have been introduced. The only structural change observed in these sub-alpine forms, being the presence of cilia on the scales. This species is highly commended by authors as a pasture grass. Mr. Sinclair observes of it, that "it is most prevalent on light rich soils, but it is likewise always found in the chest natural pastures where the soil is more retentive of moisture, and it is never absent from irrigated meadows that have been properly formed. It springs rather early, and the produce is remarkably

fine and succulent, and withstands the effects of severe dry weather in rich natural pastures, better than many other grasses." The proportional value in which this grass, at the time flowering, exceeds that at the time the seed is ripe, is as 7 to 3. DISTRIBUTION IN NEW ZEALAND: COMMON IN BOTH ISLANDS, FROM 1—4000 FEET ALTITUDE.

Reference to plate LV., B.: Fig. 1. Plant. 2. Spikelet. 3. Floret. 4, 4'. Nervation of empty glumes. 5. Nervation of flowering glume. 6. Nervation of Palea. 7. Scale. 8. Scale of sub-alpine form. 9. Section of ovary, showing glutinous patch on top.

A. Festuca scoparia, *Hook fil.*
B. " duriuscula *Linn.*

Order GRAMINEÆ.

*Genus, Bromus; Sub-Order, Festucaceæ.*

GENUS XXIV.—BROMUS, Linnæus.

*Spikelets* pedicelled, several flowered, erect or drooping, panicled. *Empty glumes* rounded on the back, rigid, unawned. *Flowering glume* rounded on the back, 7-nerved, bifid at the top, and with a straight or curved awn between the lobes. *Palea* 2-nerved, ciliate on the nerves. *Scales* 2-entire. *Stamens* 3. *Ovary* narrow, obovate and crowned on the top with a mass of glutinous hairs. *Styles* united at the base. *Grain* free, top hairy. DISTRIBUTION OF GENUS: TEMPERATE REGIONS OF BOTH HEMISPHERES. *Etymology*: From the Greek word for food, as applied to oats and other cereal grasses.

## 1.—BROMUS ARENARIUS.

**SEA SIDE BROME GRASS.**

*(Plate LVI., A.)*

BROMUS ARENARIUS, Labill, Pl. Nov. Holl., I., 23, t. 28. BROMUS AUSTRALIS, R. Brown, Prod. 178. BROMUS ARENARIUS, Labill, Bentham Fl. Austral., VII., 661. BROMUS ARENARIUS, Labill, Hook. fil., Fl. N.Z., I., 310. BROMUS ARENARIUS, Labill, Hook. fil., Handb. Fl. N.Z., I., 341.

A TUFTED, densely villous grass, of littoral habitats. *Flowers* December —February. Annual. *Culms* 3—24 inches high. *Leaves* flat, villous. *Panicle* 3—10 inches long, very broad, open, drooping, villous, branches slender, 3—5 nate. *Spikelets* green, ¾—1 inch long, on slender pedicles, 5—8 flowered. *Empty glumes* 3—5 nerved, much shorter than the flowering, pubescent or ciliate. *Flowering glume* 7-nerved, ciliate, ovate, acuminate, bifid at the top, awn as long as the glume. *Palea* linear, bifid, ciliate on the 2 nerves, with a scale oblique, acute. *Ovary* narrow, crowned on the top with a mass of glutinous hairs. *Grain* linear, with a hard hairy scale on the top, which generally breaks off.

*Styles* united at the base. DISTRIBUTION OF SPECIES: AUSTRALIA, NEW ZEALAND.

A common sea side weed, which from its dry woolly nature is very unpalatable to all kinds of stock. The general character of the genus has little in keeping with the name *Bromus*, which indicates food, for none of the species of this family are noted as superior food plants, while some of them are considered as hurtful, if not poisonous. A few of the *Brome* species are very early grasses, and valuable for keeping stock in condition till superior but later kinds spring up. DISTRIBUTION IN NEW ZEALAND: NORTH ISLAND, COMMON NEAR THE SEA.

Reference to Plate LVI., A.: Fig. 1. Plant. 2. Spikelet. 3. Floret. 4, 4′. Nervation of empty glumes. 5. Nervation of flowering glume. 6. Nervation of Palea. 7. Scale. 8, 8′. Grain, front and side view.

Order GRAMINIEÆ.

*Genus, Triticum; Sub-Order, Hordeaceæ.*

GENUS XXV.—TRITICUM, Linnæus.

*Spikelets* spiked, solitary, distichous and alternately sessile on a compressed rachis, 3 or several flowered. *Empty glumes* 2, shorter than the flowering, unequal, rigid. *Flowering glume* rigid, concave, 3—7 nerved, obtuse, acute or awned. *Palea* 2-nerved, nerves ciliate. *Stamens* 3. *Ovary* crowned at the top with a glutinous mass of hairs. *Styles* apparently lateral. *Grain* grooved in front, adherent to the palea. DISTRIBUTION OF GENUS: TEMPERATE CLIMATES OF BOTH HEMISPHERES. *Etymology:* The generic name for wheat.

## 1.—TRITICUM MULTIFLORUM.

**SHORT AWNED WHEAT GRASS.**

*(Plate LVI., B.)*

TRITICUM MULTIFLORUM, Banks and Sol., Hook. fil., Fl. N.Z., I., 311.
TRITICUM MULTIFLORUM, Banks and Sol., Hook. fil., Handb. Fl. N.Z.

A ROBUST, tufted, blueish-green grass. *Flowers* December—March. Annual or Perennial. *Culms* erect, prostrate at the base, 1—2 feet high, striate, glabrous. *Leaves* 3—6 inches long, narrow, flat, rough on the upper surface, sheathing leaves short, striate, ligule 0. *Spike* 2—8 inches long. *Spikelets* 6—12 and 6—10 flowered, ½—1 inch long. *Empty glumes* narrow, unequal, acuminate, 3-nerved. *Flowering glume* much longer, acuminate, bifid at the top, with a very short scabrid awn, 5-nerved. *Palea* obtuse, 2-nerved. *Scale* oblique, shortly ciliate. *Ovary* crowned on the top with a mass of glutinous hairs, which hardens and scales off from the grain. *Styles* connected below. DISTRIBUTION OF SPECIES: NEW ZEALAND.

**A scattered grass, seldom abundant, being generally found in distant tufts, which readily attract notice, by their peculiar blueish-green colour, among the darker coloured vegetation. This is a grass, when in flower, better adapted for**

cattle than sheep, as the stout culms and spikes offer only a coarse herbage. As a fodder grass, it would produce less bulk than its large size might suggest, as the leaves are short and soft, and the greater part of its nutrient properties would be found in the culms and spikes; this is the case, however, more or less with every grass, but the proportion of leaves to culms, in this case, is a minimum. DISTRIBUTION IN NEW ZEALAND: NORTH AND SOUTH ISLANDS, COMMON NEAR THE SEA AND ON INLAND HILLS.

Reference to Plate LVI,, B. : Fig. 1. Plant. 2. Spikelet. 3. Floret. 4, 4′. Nervation of empty glumes. 5. Nervation of flowering glume. 6. Nervation of Palea. 7, 7′, 7″. Varieties of scale. 9, 9,‘ 9″. Grain, front, side view, and section.

**A.** Bromus arenarius, *Labill.*

**B.** Triticum multiflorum, *Banks, and Sol.*

Order GRAMINEÆ.

*Genus, Triticum; Sub-Order, Hordiaceæ.*

## 2.—TRITICUM SCABRUM.

**BLUE WHEAT GRASS.**

*(Plate LVII.)*

FFSTUCA SCABRA, Labill, Pl. Nov. Holl., I., 22, t. 26. TRITICUM SCABRUM, R. Brown, Prod. 178, Hook. fil., Fl. Tasm., II., 128. AGROPYRUM SCABRUM, Beauv, Bentham, Fl. Austral., VII., 665. TRITICUM SCABRUM, R. Brown, Hook. fil. Fl. N.Z., I., 311. TRITICUM SCABRUM, R. Brown, Hook. fil. Handb. Fl. N.Z., I., 342.

A LARGE tufted, blueish-green grass. *Flowers* December—March. Annual or perennial. *Culms* erect, prostrate at the base, 3—18 inches high, smooth, striated. *Leaves* 2—8 inches long, flat or involute, smooth or scabrid, sheathing leaves long, striate, ligule 0. *Spike* 2—6 nches long. *Spikelets* 2—8, with the awn $1\frac{1}{2}$—$2\frac{1}{2}$ inches long, 6—10 flowered, erect, alternate, scabrid. *Empty glumes* unequal, 5-nerved, much smaller than the flowering. *Flowering glume* tapering into a long awn, 3—5 lines as long as the glume, 5-nerved; *awn* flexuous, straight or curved. *Palea* obtuse, 2-nerved. *Scale* oblique, or unequally bifid, ciliate. *Ovary* crowned on the top with a mass of glutinous hairs, which scales off from the grain. *Styles* connected below. DISTRIBUTION OF SPECIES: AUSTRALIA, TASMANIA, NEW ZEALAND.

**An abundant grass in both islands, from sea level to 3000 feet altitude. It varies much in size and character, being smaller and more glabrous near the sea, and varying much in the size of the spikelets in inland districts. The species of *Triticum* are considered as annuals in New Zealand, but this must be accepted with a reservation, as it is doubtful if a true annual grass exists in the islands, the cool and moist climate of many inland localities, enabling grasses to maintain a continued growth without that amount of heat-forcing which is, at all times, necessary to ripen seed the first year, for there certainly exists an inherent tendency, in many grasses, to flower and seed at an early stage of their growth, and before stoles are thrown out from the roots. In such cases, the plant is**

exhausted and dies, and may be considered as an annual, although the species may be continued on the same ground from shaken seed. This is undoubtedly the theory of certain supposed perennial grasses, such as *Lolium perrene* proving sometimes annual, and such grasses can only be secured perennial, by cutting or grazing down the flowering stems for one or more years, till each seedling plant has thown out numerous stoles from the root before ripening any seed, by which time a thick close sward has been formed. Some grasses again, such as *Dactylus glomeratus*, require no such attention, possessing as they do, an inherent tendency to delay the process of flowering and seeding for some years, by which time each seed has formed a small tussac, and by their confluence a close sward, thus proving a true perennial grass. In the South Island, the species under notice, *Triticum scabrum*, was considered by the early settlers as a good grass for horses and cattle, and was known by them as the "blue tussac grass," or "blue oat grass," a pardonable error in the latter name, the spikes being more like oats than wheat. A very marked variety of this species has been figured here under the name *Triticum scabrum, var. tenue.* This grass is abundant in some of the inland districts of Nelson and Canterbury. It is a weak elongated form, 3—4 feet long, and often trailing on the ground; other varieties exist of less importance, varying in the size of the spikelet and amount of scabridity. All the varieties, if cut in flower, make excellent fodder grasses. DISTRIBUTION IN NEW ZEALAND: ABUNDANT IN BOTH ISLANDS.

Reference to Plate LVII. A.: Fig. 1. Plant. 2. Spikelet. 3. Floret. 4, 4′. Nervation of empty glumes. 5. Nervation of flowering glume. 6. Nervation of Palea. 7. Scale. 8, 8′, 8″. Grain, front, side, and section views.

Reference to Plate LVII. B.: Fig. 1. Plant. 2. Spikelet. 3. Floret. 4, 4′. Nervation of empty glumes. 5. Nervation of flowering glume. 6. Nervation of Palea. 7. Scale. 8. Section of ovary, showing the position of the styles.

A. Triticum scabrum, *R. Brown.*

B. " " var tenue.

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Order GRAMINEÆ.

*Genus, Triticum; Sub-Order, Hordeaceæ.*

## 3.—TRITICUM YOUNGII.

TRITICUM YOUNGII, Hook. fil., Handb. Fl. N.Z.

*Leaves* quite glabrous below, slightly scabrid on the upper surface. *Spike* 2—3 inches long, of 3 or 4 very large spikelets 4 inches long. including the awns. *Empty glumes* $\frac{1}{3}$ inch long, acuminate margins membranous. *Flowering glumes* nearly $\frac{3}{4}$ inch long without the awn, which is $1\frac{1}{2}$—2 inches long, very stout, rigid, scabrid, concave at the back, concave in front with scabrid edges, margin and sides of glumes scabrid and almost aculeate. DISTRIBUTION OF SPECIES: MIDDLE ISLAND: GRASSY FLATS, SOURCES OF THE WAITAKI, AT 3000 FEET ALTITUDE—Haast.

There is no specimen of this grass in the Colonial Herbarium, and cannot therefore be figured. This appears to be a very rare grass, and probably confined to the district in which it was originally discovered. Hooker says of it Handb. Flora N.Z., I., 343, "a remarkable plant, with few spikelets, almost twice as large as those of *Triticum scabrum*, and very long rigid awns."

Order GRAMINEÆ.

*Genus, Gymnostichum; Sub-Order, Hordeaceæ.*

## GENUS XXVI.—GYMNOSTICHUM, Schreber.

*Spikelets* spiked, sessile, alternate on a flattened rachis, 1—3 flowered. *Empty glumes* wanting or reduced to a pair of flat bristles. *Flowering glume* acute or awned, seated on a thickened callus. *Palea* 2-nerved, nerves ciliate at the back. *Scales* 2-lobed, ciliate. *Ovary* crowned on the top with a mass of glutinous hairs. *Styles* apparently remote at the base. *Grain* linear. DISTRIBUTION OF GENUS: NORTH AMERICA, NEW ZEALAND. *Etymology:* From two Greek words, "naked" and "a rank," in reference to the absence of glumes.

## 1.—GYMNOSTICHUM GRACILE.

**SLENDER GLUMELESS GRASS.**

*(Plate LVIII.)*

GYMNOSTICHUM GRACILE, Hook. fil., Fl. N.Z., I., 312, t. 70. GYMNOSTICHUM GRACILE, Hook. fil., Handb. Fl. N.Z., I., 343.

A TALL slender grass with prostrate branching stems. Perennial. From sea level to 2000 feet altitude. *Culms* slender, 2—4 feet high. *Leaves* narrow, flat, smooth or rough; *sheaths* smooth, often membranous; *ligule* 0. *Spike* 4—8 inches long, slender, inclined, rachis flat, flexuous, edges ciliate. *Spikelets* 20—30, sessile, alternate, $\frac{1}{4}$— $\frac{3}{4}$ inch long with the awns, 1—3 flowered. *Empty glumes* 0, or replaced by 2 persistent bristles, or narrow rigid 1-nerved glumes; *florets* 1—3, lower pedicelled; *upper floret* generally imperfect, each with a callus at its base. *Empty glumes* or bristles, 1-nerved. *Flowering glume* 5-nerved, scabrid; *awn* short. *Palea* obtuse, ciliate at top. *Scales* 2-lobed, ciliate; *ovary* crowned with a mass of glutinous hairs, which scale off from the ripe grain. *Styles* united at the base. DISTRIBUTION OF SPECIES: NEW ZEALAND.

A variable grass, found near bush or in sheltered places. It is usually prostrate and straggling, numerously branched, and with the leaves often springing from knotted articulations. When in flower, the empty glumes are frequently absent, but they are sometimes represented by a pair of rigid-looking bristles, which will be found on examination of fresh specimens, to be narrow, 1-nerved, rigid glumes, having an upper and lower relative position. The peculiar gluten mass crowning the ovary, so characteristic in *Triticum*, is also present, showing a close alliance to that genus. The value of this grass in pasture must, from its rarity and straggling habit, be of little value, as it never forms a close sward, and it is also doubtful if it could be improved by cultivation. DISTRIBUTION IN NEW ZEALAND: NORTH ISLAND: WOODS AT PATEA AND TARAWERA—Colenso; AUCKLAND—Kirk. MIDDLE ISLAND: NELSON—H. H. Travers; AKAROA, Raoul; OTAGO LAKE DISTRICT—Hector and Buchanan; EAST COAST, OTAGO—Buchanan.

Reference to Plate LVIII: Fig. 1. Plant. 2. Spikelet. 3. Floret. 4. Nervation of empty glumes. 5. Nervation of flowering glume. 6. Nervation of Palea. 7. Scale. 8. Section of ovary.

Gymnostichum gracile, *Hook. fil.*

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# ADDENDA.

Order GRAMINEÆ.

*Genus, Stipa; Sub-Order, Stipaceæ.*

GENUS, XII., 2.—STIPA, Linnæus.

*Spikelets* pedicelled, 1-flowered, panicled or sub-racemose, erect. *Empty glumes* persistent, membranous, keeled. *Flowering glume* rigid, rolled round the flower, with a terminal bent awn, spirally twisted below the bend, and articulating on the flowering glume. *Palea* and grain enclosed in the glume. *Scales* large. DISTRIBUTION OF GENUS: TROPICAL AND TEMPERATE REGIONS OF BOTH HEMISPHERES. *Etymology:* From the Greek word for tow, made from flax.

## STIPA PETRIEI, n.s.

**PETRIE'S STIPA.**

*(Plate, XVII., 2.)*

AN elegant tufted grass, with long wiry roots, found at 1000 feet altitude. *Flowers* December—January. Perennial. *Culms* numerous, 12—18 inches high, erect, slender, smooth, grooved. *Leaves* shorter than the culms, erect, smooth, involute, filiform. *Sheathing leaves* long; *ligule* membranous, sheathing. *Panicle* erect, 3—8 inches long, broad at the base and tapering to an acute top; *branches* filiform in distant whorls, each branch with from 2—5 terminal spikelets. *Spikelets* $\frac{1}{8}$ inch long, 1-flowered. *Empty glumes* membranous, glabrous, upper 3-nerved. *Flowering glume* shorter, rolled round the palea and seed, villous on the back, and with a short circle of hairs at base, 5-nerved, bifid at the top, with a long central bent or waved awn, which is spirally twisted near the bottom. *Palea* bifid, 2-nerved, villous or with scattered hairs on the

back. *Scales* linear, very obtuse. *Anthers* long. *Grain* narrow, smooth. DISTRIBUTION OF SPECIES : NEW ZEALAND.

This beautiful and interesting grass was discovered by Mr. Petrie on a recent visit to the Lake District of Otago, proving that much still remains to be done before the botanical treasures of these inland mountain districts are exhausted. Several grasses new to science, as also some new to New Zealand, although found previously in Australia and already described by authors, have been added to the flora of New Zealand since the publication of Hooker's Handbook of the Flora, and these discoveries should stimulate those who have opportunities of visiting the interior districts to make collections. Nothing is known of the value of this grass in pastures, but species of *Dichelachne*, to which the present is closely allied, are valuable pasture grasses ; however, it is certainly worthy of cultivation as an ornamental grass. DISTRIBUTION OF SPECIES IN NEW ZEALAND : SOUTH ISLAND : CROMWELL, OTAGO, 800—1000 FEET—W. Petrie.

Reference to Plate XVII., 2.: Fig. 1. Plant. 2. Spikelet. 3. Floret. 4, 4′. Nervation of empty glumes. 5. Nervation of flowering glume. 6. Nervation of Palea. 7, 7′. Scale. 8, 8′. Grain, front and side views.

Stipa Petriei *n.s.*

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Order GRAMINEÆ.

*Genus, Deyeuxia; Sub-Order, Agrostideæ.*

GENUS XIV., 2.—DEYEUXIA, Clarion.

*Spikelets* pedicelled, 1-flowered, panicled or spike-like, the rachis of the spikelet articulates above the 2 empty persistant glumes. *Flowering glume* membranous, with a fine dorsal awn, which is usually bent and twisted, sometimes minute, rarely wanting, tufted at base with silky hairs, and with a long pencil of hair proceeding from the terminal rachis. *Palea* membranous, half or nearly as long as the flowering glume. *Grain* enclosed in the glume and palea, free, or partially adhering. DISTRIBUTION OF GENUS: TROPICAL AND TEMPERATE REGIONS OF BOTH HEMISPHERES. *Etymology:* Name in honour of M. Deyeux, a French chemist.

## DEYEUXIA SCABRA, BENTH.

**AUSTRALIAN BENT GRASS**

*(Plate XXVI., 2.)*

AGROSTIS SCABRA, R. Br. Prod. 172, Hook. fil. Fl. Tasm., II., 116, t. 160. AGROSTIS RUDIS, Rœm. and Schult. Syst., II., 360. CALAMAGROSTIS RUDIS, Steud. Syn. Glum., I., 192. A CONTRACTA, F. Muell., Herb. Hook. fil., l.c., t. 161. A DECIPIENS, R. Br. Prod. 172. CINNA DECIPIENS, Kunth., Enum., I., 207. DEYEUXIA SCABRA, Benth. Flora Australiensis, VII., 583.

A TALL, tufted, soft-leaved grass, found at 1500 feet altitude. *Flowers* December—January. Perennial. *Culms* 1—2 feet long, smooth, weak, and decumbent at the base. *Leaves* smooth, flat, striated, flaccid, narrow, much shorter than the culms; *sheaths* striated; *ligule* short, truncate. *Panicle* 2—8 inches long, much contracted, the short capillary branches scattered, or in distant whorls of two or four. *Spikelets* shining, pale straw-colour. *Empty glumes*, 3-nerved, lateral nerves very short. *Flowering glume* sharply bifid at the top, and with a

central short dorsal awn; *scabridus* 5-nerved. *Palea* nearly as long as the glume, trifid at the top. *Rhachis* produced into a long pencil of hairs, and a circle of hairs round the base of the flowering glume. *Scale* narrow, acute. *Anthers* long. *Ovary* pubescent on the top. DISTRIBUTION OF SPECIES: QUEENSLAND, NEW SOUTH WALES, VICTORIA, TASMANIA, NEW ZEALAND.

The present species was collected by Mr. Petrie, on Swampy Hill, near Dunedin, but as it is a common grass in Australia, and having only been found in the vicinity of extensive grass cultivations and of a shipping port, must be considered as a doubtful native until it has been found in other places; nevertheless, as few collectors have given much attention till recently to this family of plants, it may have been hitherto overlooked. Should this grass prove indigenous to New Zealand, it will be necessary for the purpose of preventing confusion, that the genus *Deyeuxia* be added to the flora, in consequence of *Agrostis parviflora*, a New Zealand species, having been identified with a common North American species, *Agrostis scabra*, Willd, "Flora Australiensis, VII., 576," and as Hooker in his arrangement of the New Zealand grasses has united *Deyeuxia* and *Agrostis*, confusion would arise from having two species with the same specific name, it would therefore be necessary in any future arrangement that such an anomaly should be provided for by separating the two genera. DISTRIBUTION OF SPECIES IN NEW ZEALAND: SWAMPY HILL, DUNEDIN—W. Petrie.

Reference to Plate XXVI., 2.: Fig. 1. Plant. 2. Spikelet. 3. Floret. 4, 4'. Nervation of empty glumes. 5. Nervation of flowering glume. 6. Nervation of Palea. 7. Scale. 8. Ovary.

Deyeuxia scabra. *Benth.*

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Order GRAMINEÆ.

*Genus, Danthonia; Sub-Order, Avenaceæ.*

# DANTHONIA THOMSONII, n.s.

**THOMPSON'S NAKED OAT GRASS.**

*(Plate, XXXVI., 2.)*

A TUFTED grass, found at 1—2000 feet altitude. *Flowers* December—January. Perennial. *Culms* 10—18 inches long, erect. *Leaves* 6—7 inches long, very narrow, involute, smooth. *Sheathing leaves* long; *ligule* 0, or a line of short hairs round mouth of sheath, and long cilia on both sides. *Panicle* 2—3 inches long, contracted, open only when flowering, shortly branched. *Spikelets* few, $\frac{1}{3}$ inch long, 6—8 flowered. *Empty glumes* large, longer than the spikelets, 5-nerved. *Flowering glume* glabrous, shortly 2-fid at the top, with a short central awn, 7-nerved, and with 2 pencils of long hairs on each margin, pedicel with short tufts of hairs. *Palea* bifid, 2-nerved. *Scales* broad, 3-lobed and crowned with cilia. DISTRIBUTION OF SPECIES: NEW ZEALAND.

This addition to the genus *Danthonia* was recently discovered by Mr. Petrie, on Mount St. Bathan's, Otago. It is closely allied to *Danthonia nuda*, differing only in greater size, and the presence of 2 pencils of hairs on each margin of the flowering glume, instead of 1 pencil as in that species. These characters being constant without intermediate forms, necessiates a new name for the purpose of distinguishing these grasses, although if this grass had been discovered first, *Danthonia nuda* might only have been considered as a small variety. This additional species to that variable group of the genus of which *Danthonia semiannularis* is the type, may be considered as equally valuable in nutrient qualities and bulk as any of the others, and worthy of cultivation. The whole of this family of grasses possess a large butter producing capacity, the presence of which is easily proved to the experienced farmer, by merely chewing the culms, the flavour of the sap being as satisfactory a test to him as any analysis. DISTRIBUTION IN NEW ZEALAND: SOUTH ISLAND: MOUNT ST. BATHAN'S, OTAGO, 1—2000 FEET.

Reference to Plate XXXVI., 2.: Fig. 1. Plant. 2. Spikelet. 3. Floret. 4, 4'. Nervation of empty glumes. 5. Nervation of flowering glume. 6. Nervation of Palea. 7. Scale.

Danthonia Thomsonii. *n.s.*

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